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CONTENTS.

EDITORIALS:
Electrical Construction at the Panama-Pacific Exposition. 353
Local Associations for Contractors..... 354
Electric Cooking Apparatus..... 354
Service 355
Protection Against High-Frequency Surges..... 355
DEPARTMENTS:
Commercial Practice 360
Electrical Construction 364
Public Service Commissions..... 368
Questions and Answers..... 370
New Electrical and Mechanical Appliances..... 382
Latest Approved Fittings..... 386
Current Electrical News..... 387
Record of Electrical Patents..... 391
LEADING ARTICLES:
Electricity in a Cold-Storage Plant..... 357
Wiring and Conduit Work at the Panama-Pacific Exposition.—By A. A. Willoughby..... 365
Auxiliary Steam Plant of the Vancouver Island Power Company.—By H. W. Beecher..... 373
BOOK REVIEWS..... 381
MISCELLANEOUS:
Max Hebgen..... 356
Program of Convention of Iron and Steel Engineers..... 356
Special Rejuvenation at Los Angeles..... 356
Details of Cincinnati Appliance Campaign..... 360
New Offices for Beverly Company..... 361
Central-Station Service for Beef Warehouse..... 361
New Lighting Installation for Paducah..... 361
Thomas F. Kelly..... 362
Outdoor Illumination by Large Units..... 363
Portable Stone Crusher on Central-Station Service..... 363
Civic Celebration Marks Inauguration of New Street Lighting in South Boston..... 363
Examination of Electricians in Massachusetts..... 364
Among the Contractors..... 368
Meeting of Toronto Contractors..... 368
Plans for Prosperity Week in Louisville..... 369
The Lighting of Rifle Ranges..... 372
Electrical Exports to South America..... 372
Organization of Ohio Power Companies Perfected..... 378
Program for Panama-Pacific Convention..... 379
Lighting Installation Guards Factory From Intruders..... 379
Program of Electrochemical Society..... 380
Graphite 380
Program of Convention of Southeastern Section, N. E. L. A. 380
Government Exhibits at New York Electrical Show..... 381
New York Municipal Telephone Service to be Investigated 381
Municipal and Government Electric Railways in Ontario... 381

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ELECTRICAL CONSTRUCTION AT THE PANAMA-PACIFIC EXPOSITION.

One of the notable features of the Panama-Pacific International Exposition is the electrical installation and especially that portion of it which has to do with the illumination of the Exposition buildings and grounds. In the issue of June 5 of this year, a description of the lighting details of the Exposition was given and in the present issue there is begun an account of the design and installation of the underground conduit and cable and transformer installations for supplying the electric energy which is being used for both lighting and power.

The electrical installation at the Exposition presents features which are to be found in connection with but few other projects. While the installation may be regarded as a temporary one, it was nevertheless desired to avoid as far as possible any overhead wiring and to keep the supply cables as far as possible under ground. Considerations of expense would naturally lead to a design which would not be so suitable for a permanent installation, and in addition to this the soil conditions were such that more rigid construction than that used would hardly be indicated. The ground upon which the Exposition has been laid out consists largely of an area which has been filled in with sand at such a recent period that it was settling at a rapid rate at the time construction upon the grounds was begun, and is still settling at a slower rate. The amount of this settlement is indicated in a diagram illustrating the article which is begun in this issue. Having in mind the various factors which would affect the operation of this system, it was decided to use fiber ducts inclosed in a wooden trough, and to utilize wooden manholes.

The selection of cables, transformers and meters was influenced very largely by the arrangement which was entered into with the Pacific Gas and Electric Company, according to the terms of which this equipment will be taken over by the power company at the end of the Exposition period and utilized by it in its regular construction work. This fact dictated a selection of types and sizes which would meet the requirements of the power company in its ordinary work and at the same time meet all the requirements of the Exposition installation. The details of the design and installation of this equipment will be found in the article referred to.

The design of the transformer vaults was dictated largely by considerations of fire hazard and it will be noticed that concrete construction was used for this

purpose and that the vaults were kept entirely outside of the Exposition buildings. These buildings being of a temporary nature, have not the fire-resistant properties which would ordinarily be found in buildings of more permanent construction and consequently the greatest care was necessary to prevent any danger being introduced by the electrical equipment.

The entire installation as here described has proven completely satisfactory in operation and has fulfilled all expectations in connection with it. There have been no serious failures in operation so far, and great credit is due those who have been responsible for the design and the construction work.

Mr. G. L. Bayley, the responsible head of the Electrical Department of the Exposition and Mr. L. F. Leurey, who has been in direct charge of the electrical construction and operation, are both to be congratulated upon the success of this work, which involved so many unique conditions and called for a layout that is not ordinarily found in routine work. The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN is glad to be able to present this account by its Pacific Coast correspondent of a rather unique electrical achievement and one which no doubt will serve as a model installation in future work of the same kind.

LOCAL ASSOCIATIONS FOR CONTRACTORS.

The electrical contractor is coming to realize more and more the value of organization. This is manifest not only in the activities of the national and state associations, but in many local organizations which have helped to weld together the interest of local contractors and prevent the antagonism and reckless price cutting which has so often occurred in the past, leaving a record of disaster in its wake. The electrical contracting business has had to meet problems common to a number of other industries and trial has usually shown that these problems can best be handled by co-operation, whereas the individual can do little to improve local conditions. It sometimes seems to be a slow matter for such associations to accomplish anything, but it is really necessary first of all for men to get acquainted before they can achieve much in the way of co-operation, and there must be a real intent to achieve something, which will stimulate a desire for participation in association activities. There must also be what often appears as a very unselfish willingness for service, which, however, in the end usually redounds to the benefit of those who take an active part in securing the desired results.

Much has been accomplished by organizations of electrical contractors in the past and much is being accomplished today, but there still remains a great deal to be done and there are many communities where the local contractors are hardly on speaking terms with each other. Thorough organization and co-operation is needed, both nationally and locally, and there are many problems which can be met by local associations better than by the national organization, which, too, has enough problems of its own to absorb all of its available energy. The sooner electrical contractors learn to organize and to co-operate through local associations, the sooner will the problems of the electrical industry in their respective locations be solved.

ELECTRIC COOKING APPARATUS.

It frequently happens that machinery or apparatus which is designed and constructed with entire satisfaction so far as the electrical features are concerned, is found unsatisfactory or actually fails because of insufficient attention to the mechanical details. We have noticed this fault in electrical heating and cooking appliances, and the matter is again brought to our attention by the account given by a correspondent in the *Electrical Times,* of London, of his experience with an electric stove of American manufacture. It is upon details that successful operation of a device depends, and in this case some of the details seem to have been sadly neglected.

This particular stove was of the fireless type, with automatic switch and thermostatic control. The results of the cooking operation seem to have been entirely satisfactory and the energy consumption was low, so that the correspondent speaks enthusiastically of the cost and of the culinary success. He seems, too, to be converted to the policy of slow cooking at low temperatures, a practice which is not very general or very popular in England.

The picture presented, however, is not such a rosy one when the correspondent comes to consider the mechanical performance of the stove. It was evidently not rugged enough to stand ordinary hard usage. Details of design appear to have been defective and breakdowns have been frequent enough to be discouraging. Methods of avoiding the trouble are so obvious that the owner has improved certain points when making repairs. Thus the boiling over of liquid contents has caused short-circuits, a contingency that might readily be foreseen. Brass wire has been used in places, and this has corroded. Insulation has broken down; and so the story goes.

The owner of this stove happened to be an individual who could make proper repairs. The ordinary housewife, however, is in a different position, and failure of the apparatus in these respects is likely to lead to its abandonment, while at the same time electric cooking receives a blow to its reputation which will be lasting in certain minds. Before electric cooking can become popular, apparatus must be put out which will stand ordinary usage. We believe this is being done today and at least some of the manufacturers are realizing and are meeting the demands of this service. The way is thus being opened for a wide development of electric cooking.

That this development is coming in this country is not to be doubted. Power companies in the West have taken the matter up seriously and are dealing intelligently with the rate problem. The Duluth Edison Electric Company has a rate of 2.4 cents per kilowatt-hour, and in some hydroelectric territory it is lower.

SERVICE.

A central-station company may consider its function to be the supply of electrical energy or the furnishing of a certain service. Properly both are involved. Some companies place emphasis upon one, some upon the other. Since the first is always understood, it seems desirable to place the emphasis upon service, as the importance of this element is not always realized.

The rendering of service may be interpreted in many ways. To some officials it means little more than the furnishing of energy, in other words, keeping voltage upon the supply lines. To others it means that this voltage shall be steady and of the nominal value and that interruptions shall be few and far between. To others it connotes free lamp renewals, or possibly the maintenance of an appliance department. To others it suggests the supply of illuminating engineering advice or other services usually performed by a consulting engineer. To others it signifies the courteous attention in the office to the wants of customers, the speedy investigation of complaints and the prompt correction of any mistakes which may have been made. And so we might go on. Each individual conjures up a different picture, depending upon his past experience, his present ideals, etc.

The modern central-station manager is expanding his idea of service still further. To popularize the use of electrical energy in ever broadening lines, he aims to relieve the consumer of all care in connection with central-station service. This is not only a convenience to the consumer, but it enables the central station to ensure adequate conditions of use and thus control to some extent the reputation of electrical applications. This attitude was early manifested in the furnishing of lamp renewals, but for a long time the principle involved received no other application. Now, however, it has been extended.

A notable instance is found in the electric sign. Some companies not only arrange for switching current off of signs for their patrons at a stated hour in the evening, but undertake entire maintenance of the same, replacing burned-out lamps, painting at intervals and supplying whatever other care or repairs may be necessary. Such service need not be supplied gratis. A reasonable charge is expected and should be applied. In some instances the central station retains ownership of the sign, so that the arrangement simmers down to a case of hire as well as maintenance and current supply and the charge made must include interest on the investment.

Another application of this idea is found in the furnishing of battery service for electric vehicles. The care of an electric vehicle resolves itself largely into the care of the battery, and if an owner can be relieved of this burden, there is an extra inducement for him to take up the electric as the most satisfactory solution of his transportation problems. This represents another opportunity for the central station to increase its usefulness and its business. By handling a large number of batteries in one place, the problem of battery maintenance is much simplified, and by selling the customer his energy in the chemical form rather than the electrical, it is really made more available for the latter's use. This represents service in the fullest sense of the word, although the furnishing of energy is still at the bottom of the proposition. Perhaps the most satisfactory aspect of such service is the ability of central-station experts to keep in touch with the use of electric vehicles and to discover when things are not as they should be, before the vehicle gets a reputation for failure that is due to its abuse or improper application.

"Service" may be made to include many things; and the more it includes, the less will judgment of the power corporation rest upon the mere fact of its rate for supplying energy. The central station should make of itself an indispensable servant, and not a mere purveyor of energy.

PROTECTION AGAINST HIGH-FREQUENCY SURGES.

A variety of devices have been provided for the protection of lines against abnormal conditions, such as may be produced by lightning, by arcing grounds or even by switching. They consist mainly of arrangements which provide a path to ground from the line when the voltage reaches a predetermined value, while at the same time offering insulation to lesser voltages. Their use presupposes a high voltage as the only source of danger.

There are, however, at times, surges of moderate voltage but of high frequency or at least very steep wave front produced upon the line, and it is very desirable to provide a means of dissipating these. A recent suggestion offers a very simple solution to this problem. It is to connect a condenser between line and earth. This is of such a capacity that at normal frequency the charging current is of no moment, whereas at excessively high frequencies, the admittance of the condenser rises in proportion to the frequency, and the condenser current is of sufficient magnitude to relieve the line.

For high-voltage lines the problem becomes one of finding a suitable condenser, since it is not easy to design one with the necessary electric strength while having at the same time a suitable capacity. The Moscicki type of condenser seems to meet these requirements better than any other. It can be constructed to withstand 60,000 volts. The usual form is a glass tube with metallic coatings, both inside and out, and provision for avoiding discharges at the edges.

The use of such a condenser does not involve a spark gap with its uncertainties, it requires no attention, it does not permit current of line frequency to follow a discharge, and it is used without a series resistance, although a fuse should be provided in case of condenser breakdown. The condenser does not afford protection against high voltages of low frequency, and hence does not displace the spark gap or other device for this purpose, but merely supplements it.

MAX HEBGEN.

A Tribute by H. M. Byllesby.

Max Hebgen, who died in a private pavilion at the Presbyterian Hospital, Chicago, on the morning of Tuesday, August 24, was forty-six years of age. He was born in Milwaukee, Wis., of German parentage. He began his distinguished career in the great hydroelectric development of this country with the Standard Underground Cable Company and the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., about 1886. After working in the shops of these companies, Mr. Hebgen located in Butte, Mont., taking employment as a lineman with the old Butte Electric Light and Power Company, about 1888. This company at that time was principally owned by ex-Senator William A. Clark, of Montana, and his immediate associates.

Mr. Hebgen remained continuously in the employ of this company through its various absorptions, and at the time of his death was vice-president and chief engineer of the Montana Power Company. This company, which is a monument to the creative genius of Mr. Hebgen, has water-power developments on the Big Hole River; on the Missouri River, at Great Falls; on the Yellowstone River, at Billings; and two large developments on the Madison River, all in the state of Montana. This company, which is one of the largest hydroelectric companies in existence, has been uniformly successful, both as an operating company, with the successful solving, largely from an original standpoint, of the many engineering problems encountered; as well as conspicuously successful financially. Among the many fields filled by the Montana Power Company is the supplying of electricity for the electric operation of the Butte, Anaconda & Pacific Railroad and the electrification, now under way, of the Bitter Root Mountain division of the Chicago, Milwaukee & Puget Sound Railway.

The large activities of Mr. Hebgen had extended from the experimental and pioneering period of long-distance transmission and hydroelectric development up to the present situation of the Montana Power Company, which can truthfully be said to be the at-present last word on successful hydroelectric, long-distance transmission work.

Mr. Hebgen was an intense worker; a man entirely self-educated. He entered his profession endowed with magnificent health, a sound intellect, a distinct inventive capacity and an unlimited ability for hard and successful work. He was beloved by all who knew him, and it is probable that no more successful nor popular officer of any corporation has existed than Mr. Hebgen, who, while occupying this position of great popularity in the organization, also was a thorough disciplinarian, and his popularity was bottomed on the profound respect which his organization held for his character, his abilities and his physical and moral courage. Mr. Hebgen is survived by a wife and one son.

The entire field of hydroelectric, long-distance transmission, including the solving of many lightning troubles, owes a vast amount to the devoted service of Mr. Hebgen, and in his death has met an almost irreparable loss.

Program of Convention of Iron and Steel Engineers.

The ninth annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Statler, Detroit, Mich., on September 8, 9, 10 and 11.

The opening business session will be held on Wednesday, September 8 at 10 a. m. Sessions for the reading of papers will be held on Wednesday afternoon, Thursday morning and afternoon, and Friday morning and afternoon. Saturday morning will be devoted to a final business session and in the afternoon excursions and visits to plants will be made. On Thursday evening the annual banquet will be held.

The sessions on Thursday will be joint sessions with the American Institute of Electrical Engineers, two of the papers presented being provided by the latter society.

The following program of papers has been arranged:

"Improved Non-Condensing Power Plant by use of Direct-Current, Mixed-Pressure Turbine Equipment, Etc.," by R. F. Patterson; "Wire Rope and Its Relation to Steel Making," by James F. Howe; "Recent Developments in Power-Generating Apparatus," by P. M. Lincoln; "Protection and Control of Industrial Electric Power," by Charles P. Steinmetz; "Motor-Generators Versus Rotary-Converters," by E. Friedlaender; "Some of the Latest Developments in Electrical Equipment," by K. A. Pauly; "Progress in the Iron and Steel Industry and the Electric Furnace," by Karl G. Frank; "Mechanical Analogies in Electricity and Magnetism," by W. S. Franklin; "The Electrification of Steel Mills and the Use of Central-Station Power," by Brent Wiley and Wilfred Sykes; "Purchased Power for Steel Mills," by C. S. Lankton; "Some Electrical Applications in Steel-Mill Practice," by D. M. Petty; "Latest Development of Electric Cranes for Steel Mills, Manufactured by the Alliance Machine Company," by E. H. Kendall; "Installation of Electrical Equipment to Comply With Requirements of Safety," by Walter Greenwood.

Special Rejuvenation in Los Angeles.

On August 12 a private rejuvenation was held through a special dispensation from the reigning Jupiter, Homer E. Niesz, at the Los Angeles Athletic Club at 12 o'clock noon. A class of 30 was obligated. Included in this class were some of the most prominent men identified with the electrical industry in southern California.

Probably the most prominent of these was S. M. Kennedy, general agent of the Southern California Edison Company, whose name and reputation is well known throughout the country. Of the 30 who were initiated 15 were members of the active working staff of the Southern California Edison Company. They included A. W. Childs, superintendent of sales; E. H. Mulligan, district agent, Pasadena; A. B. Wollaber, district agent, Santa Monica; W. R. Neelands, district agent, Venice; Fred Schwartz, district agent, Monrovia; C. S. Walton, district agent, Los Angeles; A. A. Taylor, district agent, Pomona; Paul J. Denninger, district agent, Whittier; C. H. Peirson, advertising agent; W. L. Percey, treasurer; E. D. Stead, bookkeeper; H. M. Fay, power salesman; Harry J. Bauer, attorney, and Dr. H. C. Stinchfield, chief surgeon.

The Los Angeles Gas & Electric Corporation was represented by William Baurhyte, first vice-president; C. P. Houghton, second vice-president; C. S. Vance, third vice-president; and from the Pacific Light & Power Corporation were C. S. Ward, vice-president; E. R. Davis, general manager; A. M. Kemp, treasurer and comptroller, and Edward Woodbury, electrical engineer.

The rejuvenation was in charge of J. Harry Pieper, Tribune of Los Angeles Chapter, and was attended, in addition to the candidates, by J. G. Pomeroy, Jovian Congressman for the Thirteenth District, and James N. Colkitt, Jovian Statesman for California and Arizona. Henry F. Holland was the specially appointed Vulcan who administered the oath.

This brings the total number initiated into the Jovian Order by Los Angeles Chapter for this year up to 87, which gives Los Angeles the lead in rejuvenations.

Empire State Meeting.

The annual meeting of the Empire State Gas and Electric Association will be held in the Engineering Societies Building, New York City, on Thursday and Friday, October 7 and 8. The program for the meeting will be announced later.

Electricity in a Cold-Storage Plant.

The high load-factor and off-peak characteristics of ice-making and cold-storage plants makes this class of business particularly desirable for central stations. This article describes the electrical equipment in a typical plant which purchases its energy from the local utility.

Since the development of the raw-water system for the manufacture of artificial ice, central-station service is particularly adapted to this class of work. Formerly practically all artificial ice was made from distilled water requiring a steam plant. With the raw-water system no steam plant is required, the only heat needed for the process being in connection with the use of hot water for loosening the ice from the cans.

The subject of this article, the plant of the Consolidated Cold Storage Company, Auburn, N. Y., operates a combination ice and cold-storage business, the ice being marketed by the Crystal Ice Company, which is a local selling organization. The ice plant has a capacity of 20 tons daily, and there are in the storage warehouse 200,000 cubic feet of storage space, which is maintained at temperatures ranging from zero to the freezing point in different rooms. These storage facilities are utilized by local merchants and produce dealers, who pay a stipulated space rental. The refrigeration system is a combination of compression and brine circulation, using ammonia in the direct expansion coils, which cool the brine.

Freezing Room Showing Motor-Driven Brine Pump in Background.

Central-station service is used exclusively for light and power, and is furnished by the Empire Gas & Electric Company from its three-phase, 60-cycle, 2,300-volt mains. The three transformers are located between two poles with supporting cross arms, in the rear of the machinery room. The secondary is connected to give a three-phase four-wire system, the lighting circuits being connected between the neutral and one of the phases. The power circuits have a voltage of 220 volts.

Before taking up a description of the electrical equipment it may be well to give a brief outline of the typical ammonia compression and brine-circulation system, as installed by the Consolidated Company. The ammonia expands in the expansion coils in the brine tank, extracting the heat from the latter. The ammonia compressor is for increasing the pressure of the gasified ammonia; the condenser for cooling and liquefying the gasified ammonia. By means of the expansion valve the flow of liquefied ammonia under condenser pressure is controlled as it flows from the receiver to the expansion coils, in which a materially lower pressure is maintained by the compressor in order that the refrigerating medium may boil at a sufficiently low temperature to absorb heat from the brine, and consequently refrigerate it.

In order that some of the work of

refrigeration may be carried on while the plant proper is shut down, either because of accident or in order to avoid the expense of skilled labor during part of the 24 hours, the brine-circulating system is employed. The cooled brine is circulated through the cold-storage rooms and the ice-making tank by a brine pump, or pumps. The initial cooling effect of the evaporating ammonia is expended in the brine, which is circulated by the brine pump, as already stated.

Salt, either sodium chloride or calcium chloride is required for making the brine, and suitable insulation is provided for the brine tank, the brine cylinders of the pumps and all brine piping outside of the cold-storage compartments in order to reduce to a minimum the losses due to the radiation of cold, or more accurately speaking, the absorption of heat. In addition to the first cost of the above-mentioned items, the operating expense or power required to operate the brine pump must be considered; first, for the circulation of the brine from the brine tank through the cooling coils back to the tank; second, to overcome the friction of the brine traversing the above cycle; third, to produce sufficient additional refrigeration to make up for the heating effect produced mechanically by the circulation of the brine and the heat actually absorbed through the brine tank and brine-pipe insulation; and, fourth, to make up for the greatly reduced efficiency occasioned by the necessity of operating the refrigerating plant proper at a materially lower back pressure in order to produce a sufficiently lower ammonia temperature to make up for the second heat transfer encountered between the atmosphere of the cold-storage compartments and the ammonia gas. The increased operating expenses directly resulting from the inherent low efficiency of the brine system is sometimes as high as 25 per cent, and isolated instances have been found where the cost of circulating the brine alone was almost as great as that of cooling it. This is in reference to the cold-storage part of a plant, as in the ice-making department it is necessary to use brine, and further the ammonia coils are immersed in the brine, the latter being circulated about the tank only.

Machine-Room Equipment.

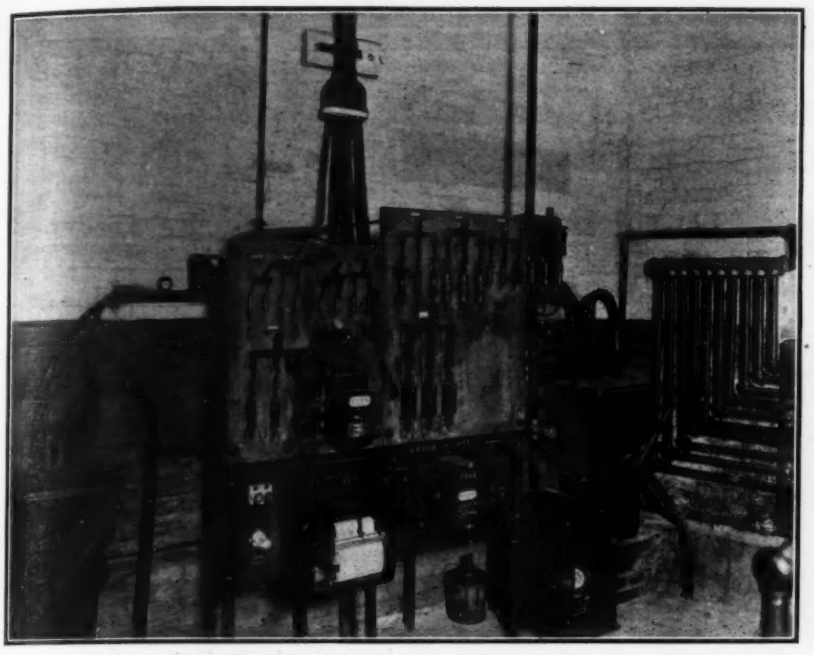
The principal unit in this department is a York 25-ton, vertical two-cylinder single-acting ammonia compressor, belt-driven by a 50-horsepower, three-phase, 60-cycle induction motor. This machine furnishes refrigeration for the entire plant. A 10-horsepower motor with the same characteristics is belted to a jack-shaft, which drives a Gould 7 by 8-inch triplex brine-circulating pump, and a Gould 5 by 8-inch triplex water pump for furnishing water to the ammonia condenser.

For handling the various lighting and power circuits a switchboard consisting of two slate panels, and an auxiliary wood base, all supported by an angle-iron frame and pipe standards, is provided. The large panel contains three motor-feeder switches and the main power switch. The smaller panel is equipped with four lighting-feeder switches, a main switch and a watt-hour meter for the lighting system. Mounted on the auxiliary panel are watt-hour meters for the power circuits and a graphic recording wattmeter with the necessary current and potential switches. A triple-pole switch is supported at the right side of the switchboard, which controls the circuit leading to the ice house in an adjoining building. From the auto-starters the motor leads are carried in conduits beneath the floor. A freight elevator operated by a 10-horsepower motor serves the various floors of the cold-storage department. Conduit work is used throughout.

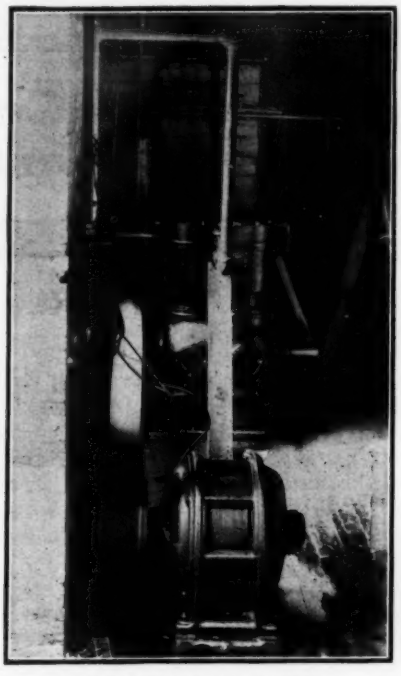
Ice-Plant Equipment.

In the ice-making department there are also several motor applications, which will be explained in connection with their applications. This department has a capacity of 20 tons of ice daily. The ice cans are approximately 1 by 2 by 4 feet, and turn out 300-pound cakes of ice. The brine tank has a capacity of 240 cans, and it requires 48 hours to freeze the contents of a can. The system of freezing and "pulling" the ice cans is as follows: At the beginning of operations half the total number of cans, 120, are placed in the tank so that they occupy every other space, both lengthwise and crosswise, of the tank. Twenty-four hours later the remaining cans are placed in the vacant spaces. Then in 24 hours from this operation the first lot of cans are "pulled" out by means of a manually

Motor Driving Brine and Water Pumps.



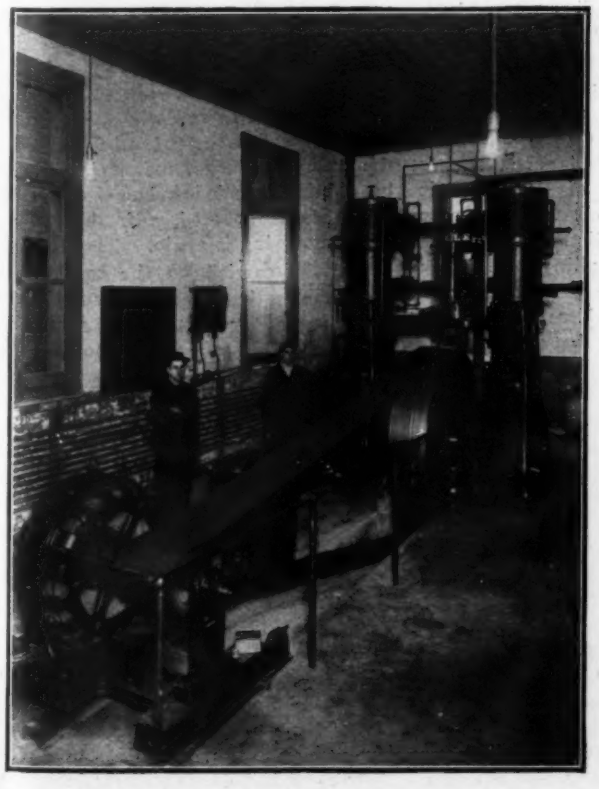
Switchboard, Showing Auto Starters for Motors.



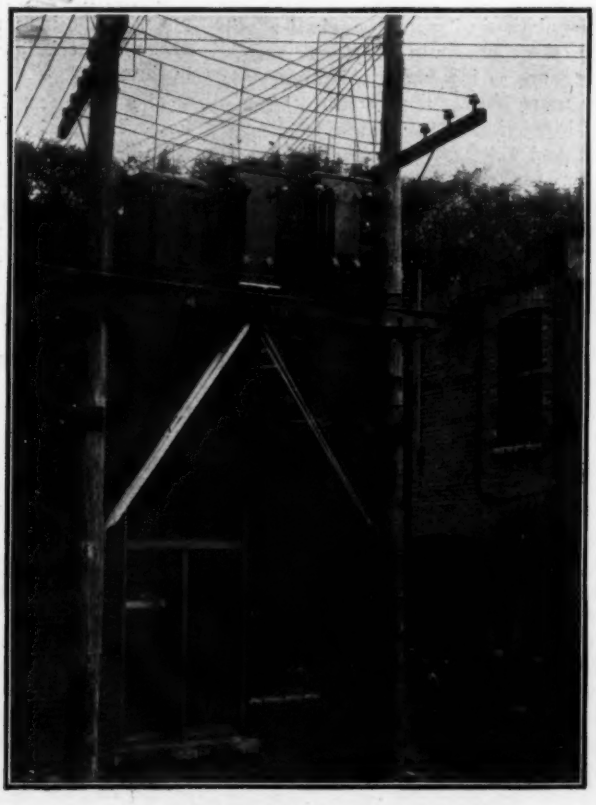
Motor-Driven Air Compressor.

operated crane. The cans that are pulled are placed on the ice-dumping machine and sprinkled with hot water. The cake of ice automatically slips out of the can and travels down a chute to the ice-storage room. The empty cans are then filled, by means of a can filler, with city water, which passes through two filters, and replaced in the tank.

There is a system of piping running between every row of cans connected to a source of compressed air. This piping has rubber-tube connections, which are attached to the can, the latter being provided with air ducts leading to the bottom of the can. The current of air passing up through the water causes the impurities and discoloration to rise to the surface, and the ice is subsequently scraped. Compressed air is furnished by a Gardner 8 by 8-inch double-cylinder air compressor belted to a 15-horsepower induction motor, and a 6-by-6-inch air compressor of the same type and make belted to a 10-horsepower induction motor. The brine in the ice-making tank is circulated by a two-horsepower vertical induction motor direct-coupled to a circulating pump.



50-Horsepower Motor Driving 25-Ton Ammonia Compressor.



Service Entrance at Rear of Ice Plant.

Commercial Practice
Management, Rates, New Business

Details of Cincinnati Appliance Campaign.

When it is stated that the sales of electrical appliances by the Union Gas & Electric Company, Cincinnati, O., in July of this year ran approximately 167 per cent ahead of such sales for the corresponding month of last year, it requires no great perspicacity to arrive at the inference that there has been some vigorous and effective work in that direction. The company's special campaign, inaugurated this spring and operated through its accessory department, in charge of R. E. Flower, manager of the "Electric Shop," is directly responsible for the increase.

The success with which the campaign has met, and the interest manifested by Cincinnati consumers in the variety of electrical appliances for domestic use which are now on the market, and sold by the company, is especially remarkable in view of the fact that cheap gas furnishes such strong competition that in the whole city, which with its immediate suburbs has a population of more than half a million, there are only 11,000 consumers. The work of increasing this number to one more closely approaching the possibilities of the population is a large one, and will be taken up after a campaign for that purpose is fully organized. Just now, however, it can truly be said that the development of the situation is being handled in remarkably successful fashion.

The fact that, as in any city, the possible customers for electrical appliances, on any date, consist only of those who are then using electricity, and that in Cincinnati the Union Gas & Electric Company is the sole concern supplying current to consumers, at once simplified the situation, as far as the attack was concerned. That is, it pointed out that the 11,000 customers on the company's books were those who could be approached, with at least the certainty that they were possible buyers of electrical goods. This, coupled with the resulting fact that these customers are directly approached monthly with their bills, formed the foundation for the campaign which has been conducted for the past few months by Mr. Flower.

The billing system used by the company, in line with that of progressive central-station companies everywhere, includes the division of the city into convenient districts, enabling a single force of meter inspectors to be kept at work constantly, and distributing the payment of the bills over the whole month. In Cincinnati there are six districts, the bills being sent by mail. Following out the line of action indicated, the same two-cent stamp which carries the bill to the customer has for some time past also carried a slip or folder calling his attention definitely to some one or more appliances, and making a specific price on it.

Frequently, for instance, these slips took the form of coupons, worth a certain amount in cash upon the purchase of designated goods. One such coupon was good for five dollars on the purchase of an electric washing machine, and another for four dollars on a combination offer of an electric iron and stove. It is not in human nature, especially the feminine half of it, to throw away lightly bits of paper of this potential value; and these coupons, and others of like nature, have proved especially valuable in securing business.

The business is actually secured, however, not by this advertising matter alone, but by close follow-ups through a compact and efficient sales force working out of the Electric Shop. It consists of 20 men, who cover district after district, beginning the day after the mailing of bills in each, for the specific purpose of selling the goods which have been advertised to the consumer that month. This means not only concentration of the sales force upon electric consumers only, and in given districts, but concentration upon certain goods, which have just been brought to the attention of those upon whom the salesmen call.

An important aid to the men in covering the field consists of an extraordinarily complete card-index of consumers, which, made up from the information on the company's books and gathered by salesmen on previous visits, covers every customer completely. Each card shows full details concerning the residence of the customer, as to the number of rooms and the like, and also shows in detail what appliances are already in use by the customer. This gives automatically a list of those which may be sold to him, as well as furnishing a possible means of attack through his favorable experience with those in use.

Each salesman, on entering a district, takes with him 50 of these cards, representing 50 consumers whom he is to cover in that district in the period immediately following the mailing of the bills. It takes several days, as a matter of course, to cover this many, and records of the work done are shown on the cards, in spaces provided for that purpose. The customer's interest in any particular device, demonstrations, trials, engagements for another call, are all shown, in order that no detail connected with a possible sale may be lost.

In this manner virtually the entire city is covered completely every month, by salesmen who, as time progresses, not only have an increasingly accurate knowledge of their individual customers, brought about by regular contact with them, but also an extremely detailed familiarity with the goods which they have to sell and the conditions under which they have to be sold and operated. Moreover, there is no apparent reason why this system, expanding with the natural increase in the number of customers, should not be continued indefinitely. As the list of goods is covered, a fresh start is made, covering it again.

The list carried on the card, however, shows that there is a sufficiently wide range for sales work with the average customer to take some time to cover thoroughly, as it includes heating pad, iron, toaster, percolator, vacuum cleaner, sewing-machine motor, washing machine, fireless cooker, curling iron, vibrator, range, reading-lamp, portable lamp, chafing dish, Mazda lamps, fans; and the extent to which the list of usable domestic accessories has been added to in the past few years indicates that further additions may be expected, almost without limit.

An especially interesting feature of the sales work of this department lies in the effective application of a merit rating system for the salesmen, which keeps the manager in close touch with their work and offers a direct incentive to the men to keep going at their best

rate. The fact that they are paid on a combination of salary and commission guarantees that each will receive approximately what he earns, and no more; but the rating system referred to is an extension of this.

It consists in a complete scoring schedule, under which every sale receives credit in the shape of points, while each lapse is marked in points deducted. One point, for instance, is credited for each dollar's worth of sales, plus another for each 50 watts' consumption added by the device sold; this is for the purpose of impressing the fact that what the company is trying to accomplish is not merely the sale of goods, but the increase in the load through an increase in the consumption of current. Ten points are credited for each hour of overtime work, whether in the office or with a customer, and ten are given for a new sales idea of value.

Deductions from credit include ten points for carelessness in reports, and the like; for tardiness; for each half-day lost, except for illness; for delayed execution of a customer's order or in filling an appointment; and others of a like nature. Thus each salesman's score, which is kept up to date daily, shows accurately what he has been doing in the way of actual work; and while the contest itself keeps the men keenly interested, as any real contest will, an added incentive to effort is given in the shape of cash prizes for the top and second men each week, of six and four dollars, respectively. And, as the records are made up daily by Mr. Flower, he is necessarily kept in extremely close touch with each man's work, which is in itself a point of considerable value.

The remarkable increase in the amount of business secured indicates sufficiently the success of the systematic selling effort being conducted, and promises well for the upbuilding of the company's business. With the application of similar methods to increasing the number of consumers, through a house-wiring campaign and by other means, it is certain that an immense advance in the domestic use of electricity in Cincinnati will be seen within the next year or so, in view of the large proportion of the population now not using current in any form.

New Offices for Beverly Company.

The Beverly Gas & Electric Company, Beverly, Mass., has just moved into its new building, on Cabot Street in that city. The company occupies one-half of the entire lower floor and the basement, as offices, stock and display rooms. The front lobby is finished in white marble and contains an attractive display of electric stoves, table appliances and lamps. In the basement are cabinets for the storage of lamps and shades.

New Office Building of Beverly Gas & Electric Company.

The company serves over 1,500 lightings customers and its power customers number nearly 100. The territory served includes, besides Beverly, the towns of Wenham, Topsfield and Hamilton, and the company sells energy to the Manchester Company. According to the last returns its kilowatt output for the year was 2,258,356 kilowatt-hours. The maximum net rate is 11 cents, with $1.00 monthly minimum. No free renewals are given.

Central-Station Service for Beef Warehouse.

Electricity has an important place in the operation of an up-to-date wholesale beef plant, in the conveying of the product to and from storage, the supply of cold air for refrigeration and the lighting of the storerooms, which of necessity are artificially lighted.

The Boston Edison Company has recently closed a contract with E. C. Swift & Company, Boston, Mass., calling for energy for power and light for a modern refrigerating plant that is said to be the finest of its kind in the world. The main "beef box" for the storage of dressed beef is 88 by 58 feet and has a capacity of 10 carloads, or 250 whole cattle, with a total weight of 250,000 pounds.

The walls are constructed of cement, with a three-inch cork insulation and glazed white tiles. Cold air blasts are supplied from the Quincy Cold Storage & Warehouse Company by motor-driven fans, and the interior is lighted by means of six rows of seven 25-watt Mazda lamps arranged in series and controlled by a push-button switch at the end of each line. Beef is run into the storeroom on Duncan overhead tracks, and elevated to other parts of the building, where smaller storerooms are provided, by means of two 3,000-pound Otis freight elevators operated by seven 5-horsepower motors at 900 revolutions per minute, located in monitors on the roof.

A sample room, egg and poultry rooms and freezer are also electrically chilled and lighted. The temperature of the main refrigerator is kept at 34 degrees and of the freezer at about 20 degrees.

The firm has expended $100,000 on the new plant, which has been under construction since March.

New Lighting Installation for Paducah.

Merchants along Broadway and the retail sections of the cross streets in Paducah, Ky., have tired of supporting the "white way" which has served that thoroughfare for two years and will leave the project in the hands of the city commission. Representing the Retail Merchants' Association, a committee has asked that the city continue to supply the present system until the first of the year, after which it is suggested that a system of ornamental standards be provided for. The present white way was originally a temporary affair, designed for use during a street carnival, but continued because of the good effect produced. The current for the installation has been supplied by the Paducah Light & Power Company.

SUCCESSFUL COMMERCIAL MANAGERS.

Thomas F. Kelly.

There is perhaps no company that enjoys a better reputation for progressiveness and originality in sales activities than the Dayton Power & Light Company, of Dayton, O. In spite of the disastrous flood of 1913 and the business depression during a large part of 1914, the business of the company has increased at an astonishing rate and indications now point to a greater increase for 1915 than during either of the two previous banner years.

To achieve the success which it has the Dayton Power & Light Company first, has always been keenly alive to the value of the "public-be-pleased" policy and has followed this rigidly. Next in importance has been the consistent and intelligent work of the sales department in familiarizing the public with the economy and conveniences of electric service for both lighting and power. Aside from the ordinary methods of obtaining business, however, many original sales and publicity ideas have been carried out in Dayton, and an appreciable share of the new business secured during the past two years can be attributed to these activities.

Thomas F. Kelly, until recently sales manager of the company, is largely responsible for the advances that have been made since 1913, and to him belongs credit for the originality which has characterized the work of the sales department. Mr. Kelly is a firm believer in newspaper advertising, whether in paid space or in the reading columns. Very frequently the Dayton Power & Light Company is engaged in some activity, either civic or industrial that is of real news value, but if such opportunity for favorable publicity is not at hand Mr. Kelly promptly creates some situation that will bring the name of the company before the public and emphasize the value of electric service. For instance, on a hot, sultry morning recently Mr. Kelly had 16-inch oscillating fans placed on the lighting standards of two of the principal streets in the shopping districts. While the fans were placed simply as an advertisement many shoppers actually found comfort in the cooling breezes, and the newspapers promptly heralded the act as another evidence of the concern of the company for the welfare and comfort of the community.

This was just one of the many stunts carried out by Mr. Kelly to keep the subject of electric service but more particularly central-station service always before the people of Dayton. That this policy has been successful is proved by the new business secured.

Thomas Fitzgerald Kelly was born at Hamilton, Ontario. In 1900 he entered the employ of the Hamilton Electric Light & Power Company as office boy. He quickly advanced through the various departments and was appointed contract agent of the company in 1907. He remained in that capacity until he resigned in January, 1913, to become sales manager of the Dayton Power & Light Company, of Dayton, O. Upon the removal of F. M. Tait, president and general manager of the company, to New York recently, Mr. Kelly was elected commercial manager, and this position he now holds.

As contract agent of the company at Hamilton, he successfully conducted

Thomas F. Kelly,
Commercial Manager, Dayton Power & Light Company.

many business-getting campaigns and many new features connected with the sale of electric light and power in Canada saw their first "light" at Hamilton.

While at Hamilton he was very active in civic affairs, in the work of the Canadian Electrical Association and the National Electric Light Association of Canada.

Mr. Kelly was one of the organizers of the Hamilton Ad Club, being its first secretary, and was re-elected for a second term, resigning as secretary when he went to Dayton.

He was the first chairman of the Commercial Section of the Canadian Electrical Association, and was the author of many papers at the annual conventions of this Association.

Mr. Kelly organized the Hamilton Electric Light & Power Company Section of the National Electric Light Association and was appointed its first president. He was unanimously re-elected for the second term, resigning when going to Dayton.

Although Mr. Kelly's connection with the Dayton Power & Light Company started less than two months previous to the flood, which visited Dayton in March, 1913, the year 1913 showed a net increase of customers served in the Dayton district alone of 33 per cent. This was considered exceptional, but was the result of the efforts made to have homes in the flooded district wired while they were being papered and redecorated. The company shortly after the flood rented from the Federal Sign System (Electrical) nine blue-enamel steel signs reading "Wire Now" and had them installed on the store fronts of the different electrical contractors in Dayton. This publicity, coupled with timely newspaper advertising bearing one of the wiring campaign slogans of the company, "Wire Now—Ask Us How," was one of the many plans used to secure this increase.

In spite of the conditions existing during 1914 the company had a net increase in customers served in Dayton district of 26 per cent.

Mr. Kelly has been in charge of the business-promotion work and since his connection with the company, it has secured the Water & Electric Light & Power Company at Wilmington, the electric light and power property at Cedarville (serving Cedarville, Clifton and Yellow Springs) the Municipal Electric Light & Power Plant at Osborn and in addition it has secured franchises and street-lighting contracts at New Carlisle, Fairfield and Bowersville.

At Dayton Mr. Kelly has also been very active in civic affairs, the Jovian Order, the Ohio Electric Light Association, the National Electric Light Association and the Electric Vehicle Association of America.

Mr. Kelly is an active member of the Retail Merchants' Bureau of Dayton and of the Greater Dayton Association. As a member of the Association he is chairman of the Community Christmas Tree Committee and of the Publicity Committee. He is an active member of the Dayton Advertising Club and is captain of one of two "efficiency" teams.

About January 1, 1914, there were about fifteen Jovians in Dayton when Mr. Kelly was appointed statesman and during his administration 178 new candidates were initiated into the Order.

At the annual convention of the Jovian Order at St. Louis, in October, 1914, he was appointed, under the change in the constitution, statesman for the state of Ohio.

In 1913 he was appointed chairman of the Committee on New Business Cooperation of the Ohio Electric Light

Association, and because of his interest in this work was re-elected chairman at the convention of the Association, held at Cedar Point in July, 1914. At the convention in July, 1915, he was made chairman of the Advertising Committee.

As chairman of the Committee on New-Business Co-operation for the past two years Mr. Kelly has conducted a series of co-operative meetings, which have established a precedent in Association affairs. Large attendances, running as high as 200, have characterized the gatherings, at which excellent programs dealing entirely with new-business topics have been presented.

In October, 1914, he was appointed by President H. H. Scott of the National Electric Light Association, chairman of the State of Ohio Membership Committee of the Association, and since that time Company Sections have been started at Dayton, Cincinnati and Mansfield, and Mr. Kelly is actively endeavoring to have Company Sections formed at Cleveland, Columbus and Youngstown. When the Company Section was formed at Dayton, Mr. Kelly was unanimously elected its first chairman.

Mr. Kelly was a member of the Membership Committee of the Electric Vehicle Association in 1914, and was reappointed by President J. F. Gilchrist for 1915. He is also a member of the Engineers Club of Dayton and of the Dayton City Club.

Outdoor Illumination by Large Units.

The new standard for outdoor illumination set by the lighting of the San Francisco Exposition is being emulated in the larger cities of the country, and it is probable that within a short time many beautiful buildings will be thrown into luminous relief by light rays from concealed sources. The Louisville Gas & Electric Company has just made arrangements to illuminate the front of the new Bernheim Building in this manner. Five projectors to be located on a roof across the street from the building will transmit the light from 500-watt type C Mazda lamps. The agents for the building are to use this method of advertising to attract desirable office tenants.

Minot Company Builds Line to Burlington.

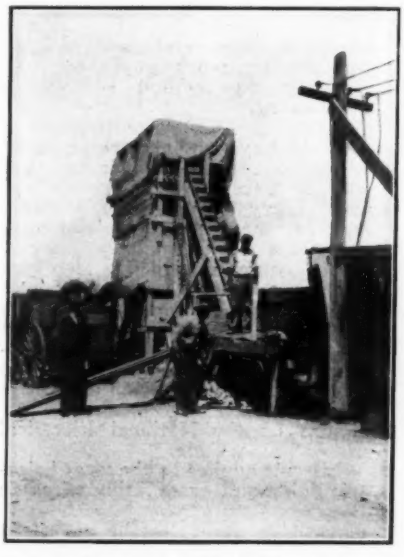
The Consumers Power Company, Minot, N. D., a Northern States Power Company subsidiary, is constructing an eight-mile extension of its lines to serve the town of Burlington, N. D. Burlington is a thriving community and about 50 houses are being wired.

Portable Stone Crusher on Central-Station Service.

An electrically operated stone crusher is an important part of the field equipment of Clark & Gore, Boston, who are constructing a section of Commonwealth Avenue in that city, with wood block on concrete.

This crusher, which has a capacity of about 100 tons a day, is located in an intersecting street, and to it is hauled by team the Telford stone paving with which the street was originally laid, consisting of large boulders and Roxbury pudding stone. This rock is crushed to a two-inch and one-inch aggregate, to enter into the composition of concrete for the new roadway.

The crusher rests on 12-by-12-inch



Portable Electrically Operated Stone Crusher.

parallel timbers 40 feet long, and in a motor house on the same frame is installed a 35-horsepower Crocker-Wheeler induction motor which operates on Boston Edison Company service, 900 revolutions per minute at 220 volts. The motor operates the crusher and also a bucket conveyor which carries the crushed stone about 25 feet to discharge chutes from which teams are loaded. The belt connecting the motor with the driving wheel is 10 inches wide and about 20 feet long, and the motor and crusher being on the same timber framework, gives rigidity to the apparatus. A 30-kilowatt transformer is located on a pole at the street curb.

When the crusher is to be moved, the timbers are raised and set upon low wheels and the whole apparatus moved as a unit by a steam roller. A section of 3,700 linear feet was served from two positions of the crusher.

Great economy was effected in not having to haul the rock a long distance to a permanent crusher, and then re-haul the crushed stone to the job, as the readiness with which the machine is moved places it within close reach of the work on which it is engaged, and in locations where steam operation would be highly objectionable, if not prohibited.

Civic Celebration Marks Inauguration of New Street Lighting in South Boston.

An improved system of street lighting on Broadway, between Dorchester Street and Dorchester Avenue, South Boston, Mass., was opened on August 16, with a public demonstration which included a parade, band concerts and a speech by Mayor Curley.

The installation consists of 69 6.6-ampere magnetite arc lamps with standard equipment, erected on 18-foot poles, following the practice of the Boston Edison Company in placing lamps with a view to utilitarian rather than spectacular considerations.

The poles are of metal pedestal and cap with wood shaft, and are set in concrete bases, the units being located opposite to one another on either side of the street, which is 43 feet between curbs, and spaced on 125 to 150-foot centers. The lamps are divided on two circuits and alternated. They replace 50 standard arcs on gooseneck poles.

Water-Heater Campaign in Boston.

The Edison Electric Illuminating Company of Boston is conducting a novel campaign for the introduction of the Cutler-Hammer water heater, which is advertised to boil water in 45 seconds.

A frame in the show window contains 25 horizontal panels, one above another, each bearing figures beginning with $25 and diminishing to $1 at the bottom. At the right is a placard which says: "One dollar off every day until sold. What price will it sell at? The frame is lighted by a lamp contained in a hooded reflector, and a sample of the apparatus is displayed in the window.

El Reno Company Builds Line to Serve Indian Agency.

An extension of nearly seven miles of transmission line is being constructed by the El Reno Gas and Electric Company to serve the Indian Agency and the El Reno Vitrified Brick Company. Other business along the right-of-way which will probably be secured includes light and power for Fort Reno, Rock Island Railway pumping load and a considerable amount of irrigation power and other business from the farmers.

Electrical Construction

Examination of Electricians in Massachusetts.

The first of the examinations of applicants for certificates and licenses under the new law in Massachsetts, which requires employing firms and journeymen workers to take out certificates in evidence of their fitness, were held in six cities of the state on August 11, and were in charge of members of the Examining Board or their agents. The following numbers of candidates took the examinations in the two classes: at Boston, 137; Lowell, 44; Springfield, 53; Worcester, 50; Fitchburg 35; Pittsfield, 13; total, 332.

The examinations were held at city halls or other public places, and consisted of questions formulated by an agent specially employed by the Examiners, as the clerk, who is the only technically trained man connected with the Board, was not selected in time. The latter will, however, mark the papers and announce the results.

It appeared that several men took the examination without first having filed a formal application. In order to cover candidates for certificates who were not informed as to the date and place of the local examination through not seeing the advertised notice, an additional examination was held at Boston August 25, when a different set of questions was propounded for answer.

The law requires two examinations in each of several convenient centers each year.

The following were the questions to which answers were required, in writing, from Class "A" applicants; i. e., employing electrical contractors:

1. Explain with sketches the ordinary three-wire system as used by the Edison Company. Show how it is possible for the system as a whole to be in balance and yet to be very badly out of balance in some places where it would be a source of danger.
2. Make drawings to show how you would distribute the lighting circuits of a large office building to be served from a low-voltage three-phase system. Any good method will be satisfactory if it can be operated with a supply voltage permitting direct connecting of the lamps.
3. Calculate the size of wires to be used for the following motors: 10 horsepower, 220 volts, 85 per cent efficiency, direct current; 5 horsepower 110 volts, 80 per cent efficiency, three-phase, 60 cycle; 100 horsepower, 2,300 volts, 90 per cent efficiency, 25 cycles, three-phase.
4. What methods are used to protect from mechanical injury the various kinds of insulations used on interior conductors of all kinds?
5. What are the provisions in the N. E. C. for the use of flexible tube?
6. What are the rules covering the use of transformers inside of buildings? When might it be necessary to so place transformers?
7. How are the several parts of interior conduit work grounded? Is the common method thoroughly satisfactory?
8. What is the difference between a three-wire system and a three-phase system as far as the installation work is concerned in a lighting layout? Draw two methods of planning for the three-phase layout.
9. How is a storage battery charged from a generator which is also supplying the lights which will later be supplied by the battery? Make sketches of the wiring used or other devices.
10. In general what are the principles governing the installation of electric heating devices?

Questions on the National Electrical Code.

1. What rule applies to the use of electric lights and gas-lighting wires on the same fixture?
2. What rule applies to the use of an incandescent lamp as a dimmer for an arc lamp on an incandescent circuit?
3. What controls the size of a fuse at a branch circuit?
4. How must a ground wire be run through a building?
5. What rule applies to the use of alternating current in iron conduits?
6. How should an economy coil of an arc lamp be installed?
7. What is the smallest size of conduit permitted?
8. How many small electric fans can be wired from one fuse block?
9. How is a ground wire connected to the ground?
10. Where may you use fused link rosettes?

The following examination was for Class "B" certificates, i. e., journeymen's:

Questions on the National Electrical Code. Give in your answer either the number or numbers of the rule, the exact wording of the rule, or the substance of the rule, as you may prefer; and if you so desire, add any explanation or reason for the rule. Answer any ten questions.

1. What rule applies to the use of electric lights and gas-lighting wires on the same fixture?
2. What rule applies to the use of an incandescent lamp as a dimmer for an arc lamp on an incandescent circuit?
3. What controls the size of a fuse at a branch circuit?
4. How must a ground wire be run through a building?
5. What rule applies to the use of alternating current in iron conduits?
6. How should an economy coil of an arc lamp be installed?
7. What is the smallest size of conduit permitted?
8. How many small electric fans can be wired from one fuse block?
9. How is a ground wire connected to the ground?
10. Where may you use fused link rosettes?
11. Where and under what conditions may slow-burning wire be used?
12. For concealed knob-and-tube work, what is the correct spacing of insulators and height of knobs?
13. Under what conditions may a single-pole service switch be used?

Questions to be fully answered in a manner that would be satisfactory if giving instructions to one seeking information. Answer four.

A. Make a sketch showing the necessary wiring and connections in order to control a single light from two places. From four places.
B. How may the three wires of an Edison circuit be quickly identified? Does your method indicate the polarity and if not how could you tell?
C. What is a hickey and where and how used?
D. How would you ground the various parts of a BX job?
E. How could you make a good ground detector suitable for constant use on a two-wire plant?
F. How could you tell whether or not a circuit was connected to an alternating-current supply?

Contracts Open.

The Belvidere (Ill.) Board of Education will receive bids until September 10 for the electric wiring, fixtures and telephones for the new high school.

City Electrician W. E. Barclay has prepared plans for a new police and fire-alarm system for Aurora, Ill. The proposed system will cost about $25,642. The matter is now before the City Council.

W. A. Thomson has plans to erect a $70,000 grain elevator in Louisville, Ky., to be electrically operated. It is stated that the Burrell Engineering Company, of Chicago, probably will get the contract. The elevator would cover 1,500 square feet and be 150 feet high, with bins 65 feet high, and would be capable of handling 100,000 bushels of corn daily.

Wiring and Conduit Work at the Panama-Pacific Exposition.—I.

By A. A. Willoughby, Pacific Coast Correspondent.

The designing of a system for the distribution of electrical energy at the Panama-Pacific International Exposition involved the careful consideration of many factors, both commercial and engineering, that rarely enter into the design of standard underground construction. The main idea to be kept in mind was the cost of installing a system which while it must be ample to cover all contingencies that might arise, yet would be constructed for only very temporary use. The intent of this article is to point out the factors that influenced the design of the system that was finally installed and designers of electrical distribution systems may be able to glean ideas helpful from the standpoint of preliminary design as well as the installation and operation of such a system. Guy L. Bayley has been chief electrical and mechanical engineer and L. F. Leurey, his assistant and engineer of operation and maintenance since the organization of the department.

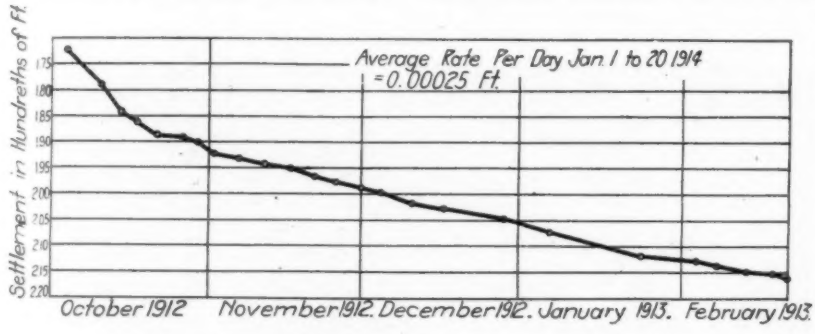


Fig. 1.—Curve Showing Rate of Settlement of Ground.

The results attained have been admirable. There has been perfect continuity of service at all times, no interruptions having been recorded since opening day and the cable system has proven itself capable without additions to the initial design, of handling all the changes in physical conditions that have arisen since the inception of the original Exposition plans. Construction costs were kept at a low figure and yet the system was as carefully designed and installed as if for permanent use, whereas its life is but for a few months. The main feature of the system lies in its flexibility and its ability to assimilate readily the various loads, particularly during the night illumination period.

A preliminary scheme covering the scope of illumination and commercial lighting and power was made as soon as the ground plans of the Exposition site had been detailed and definite roads, parkings and building locations had been determined. The illumination plan has varied but slightly from the original scheme adopted. The amount of power required for illumination was readily determined and would naturally be subject only to minor changes. The power which would be required for the exhibitors and the amusement and state and foreign sections was a more or less indefinite question up to within three or four months of the opening of the Exposition. Many factors absolutely unknown were constantly entering into this section of the work, resulting in a continually varying load characteristic from month to month. Consequently any distribution design that would be sufficient to meet the possibilities of the situation had to be ample in its allowance for contingencies and had to cover completely in its scope every individual section of the Exposition grounds.

Numerous and sudden changes later on in the Exposition period in the groupings and size of the state and foreign buildings proved the wisdom of having a cable system as complete as was installed, because changes were continually occurring in this section up to within a short time of the opening day. Not being able to forecast exactly the extent of the participation by foreign countries, the tendency of the engineers was to install a cable system as flexible as possible, having a sufficient number of cables and these so interlocked by ties that the loss of some cables could quickly be compensated for by readjusting the loads among the remaining good ones.

That so liberal a layout could have been planned was due to an advantageous contract made between the Exposition company and the Pacific Gas & Electric Company, which company fortunately had an operating system of such magnitude that it offered unusual possibilities of absorption of equipment at the close of the Exposition. Had the Exposition been compelled to purchase all of its equipment outright, with a large initial investment and shrinkage in value at the finish, a far less comprehensive system would have been installed, it being an almost universally recognized axiom in work of this character that economy in first cost far outweighs all other considerations. Consequently a much more complete system, more certain of successful continuous operation, was made possible through the contract with the Pacific Gas & Electric Company.

The contract embodies three main features, as follows:

(1) The furnishing of all illuminating gas used in the grounds, the Exposition acting as a retailer.

(2) The furnishing of electrical energy at the busbars of the power company's station, situated adjacent to the grounds, the Exposition being the retailer and to a very large extent, the consumer.

(3) The rental to the Exposition of all power apparatus used by the Exposition for transforming and distribution purposes, including pole-type transformers, lead-covered cables, double-braided secondary cables, oil switches, panelboards, overhead line material for the amusement section and outlying sections of the grounds, two 1,000-kilowatt motor-generator sets and two 250-kilowatt motor-generator sets for transforming alternating to direct current for power and lighting and for furnishing energy to the searchlamps in the scintillator and on the roofs and towers.

The basic idea of the contract was the furnishing, besides the energy, of all equipment in the transformer stations and in the distribution system within the grounds, at actual cost plus freight and cartage charges. The Exposition pays a blanket interest rate and is to dismantle and return the equipment to the power company's warehouses at the close of the Exposition period. The initial cost of the apparatus less cartage is to be credited on the return of the apparatus. The principal advantage of the contract from the Exposition point of view was an immediate saving in a large capital outlay for apparatus and enabling the transfer of funds from the blanket allotment allowed the department, and applying these funds towards securing better distribution

facilities and a more excellent illumination program than if it had been necessary to purchase the equipment outright. The contract in effect made possible the laying out of an elaborate system throughout, complete in every detail.

Engineering Features.

Practically the entire portion of the grounds where the cable system was laid, occurs in a built-up area. A great deal of the site is dredger-fill silt and sand from the bottom of the bay and consequently low and flat, being but a few feet above maximum high tide and making manhole drainage practically impossible. It was seen by the engineers that it would be difficult to lay out a self-draining duct line without enormously increasing the quantity of fill required for purely building purposes. The sewers and drains occur at such elevations that it was not possible to drain the duct line into either system. Water-filled manholes in turn introduced an unusual operating hazard, calling for more insurance against breakdowns.

The silt and sand fill being subject to more or less continuous settlement, determined the character of the conduit adopted for inclosing the cables. The curve of settlement in Fig. 1, ascertained through careful measurements taken by the engineering department, shows a continual settlement with probable decreasing speed throughout the entire Exposition period. The character of the duct line had to be such as to withstand a maximum of deflection with a minimum of induced strain. The use of concrete was out of the question, due to the fact that it was unnecessarily durable for such a short period and would not stand the strains of deflection due to settlement as well as cheaper material.

Three other types were considered. The first was the installation of a wooden pump-log system, consisting of creosoted duct held together at the joints by heavy stay pins driven in the ground and by bonded ties. The second was the use of a simple type of wooden-stave pipe. The third and the one utilized was one-eighth-inch Linaduct, packed in sand and laid in wooden troughs. This was the cheapest possible form of fiber conduit and has proven unusually successful.

It was laid in lengths varying from 14 to 20 feet. The trough was first lined with approximately an inch of sand. The conduit, having sleeve joints, was laid 0.75 inch apart and to within one inch of the outer walls. Sand having a gradation sufficiently fine as to afford an easy flow, was spread over the first layer of conduit. This was then wetted and sluiced into the interstices and making a layer above the conduit. Successive layers of conduit and sand were placed in position until the trough was filled. The trough covers consist of transverse strips of 1.5-by-8-inch and 1.5-by-12-inch lumber, sawed to size in the shop. The conduit box sections were made up in the shop, roundabout bands being nailed four feet apart and the corners being held by sheet-iron straps. The joints at the end of the box sections were made by scabs extending from one end of each section, making a butt-joint connection between the boxes proper, and extended end of the box being nailed to the next section in the field.

Fig. 2 gives a view of the conduit-laying operations, showing final layer of duct being placed prior to the box cover being put on. The manhole shown is in the low portion of the grounds in the state and foreign section, where the standing water plane is close to the surface, and is known as a shallow manhole, 4 by 4 feet in size. Intermediate U-cleats for stiffening the sandbox are shown.

This type of construction not only met all the expectations of the engineers in combatting deflection due to settlement of the soil but also possesses advantages not foreseen at the time. It was impossible to foresee the numerous openings about and under the lines at different points, undermining the conduit structure in making gas, water and high-pressure fire-service taps, covering not only the Exposition's own activities but also those of consumers. Due to the great rush of construction and the impossibility of inspection at all points where services were being installed, the duct lines were exposed in many cases as much as 6 and 8 feet. In several in-

Fig. 2.—Conduit Receiving Top Layer of Ducts, and Manhole.

Fig. 3.—Transformer Vault, Showing Cantilever Framework Construction.

stances building scaffolding was found resting on the line—in some places immediately over excavations. The most aggravated case of this kind was found where a building contractor had used the duct line as the main sill for his bridge over which he hauled his construction materials. Naturally the line sagged under these strains but not enough to cause any appreciable trouble in installing the cables.

The physical appearance of the ground had a great deal to do with the designing of the distribution system. The engineers were able to foresee that it would be impossible to install branches and services until the character of the loads to be carried had developed and permanent plans had been adopted for the various buildings and consumers' locations. To minimize cutting the macadam and asphalt pavements for late service connections, necessitated the location of the main trunk lines as far as possible in the garden strips and parking spaces adjacent to the roads on the side next to the buildings. While this had many advantages, it led to some complications in routing the trunk lines to avoid future planting of large trees and the avoiding of kiosks and small buildings bordering the avenues. Other complications occurred during the construction of the lines due to the vegetation and flowers already planted. The chief obstacle encountered was in the disposition of the parking spaces which were terraced around the main group of exhibit palaces for architectural reasons, so that in crossing under the various court entrances, the lines had to be depressed as much as four feet below the terrace levels. By the plan of using the parkings, more manholes were required than if the conduit had been laid in the streets, but the extra cost has been more than balanced by the added advantages, particularly in the ease in making extra service taps. A considerable saving was effected through the use of the parkings rather than the streets adjacent to the buildings, in the lesser amount of cable necessary between the main source of supply and the transformer vaults in the various buildings.

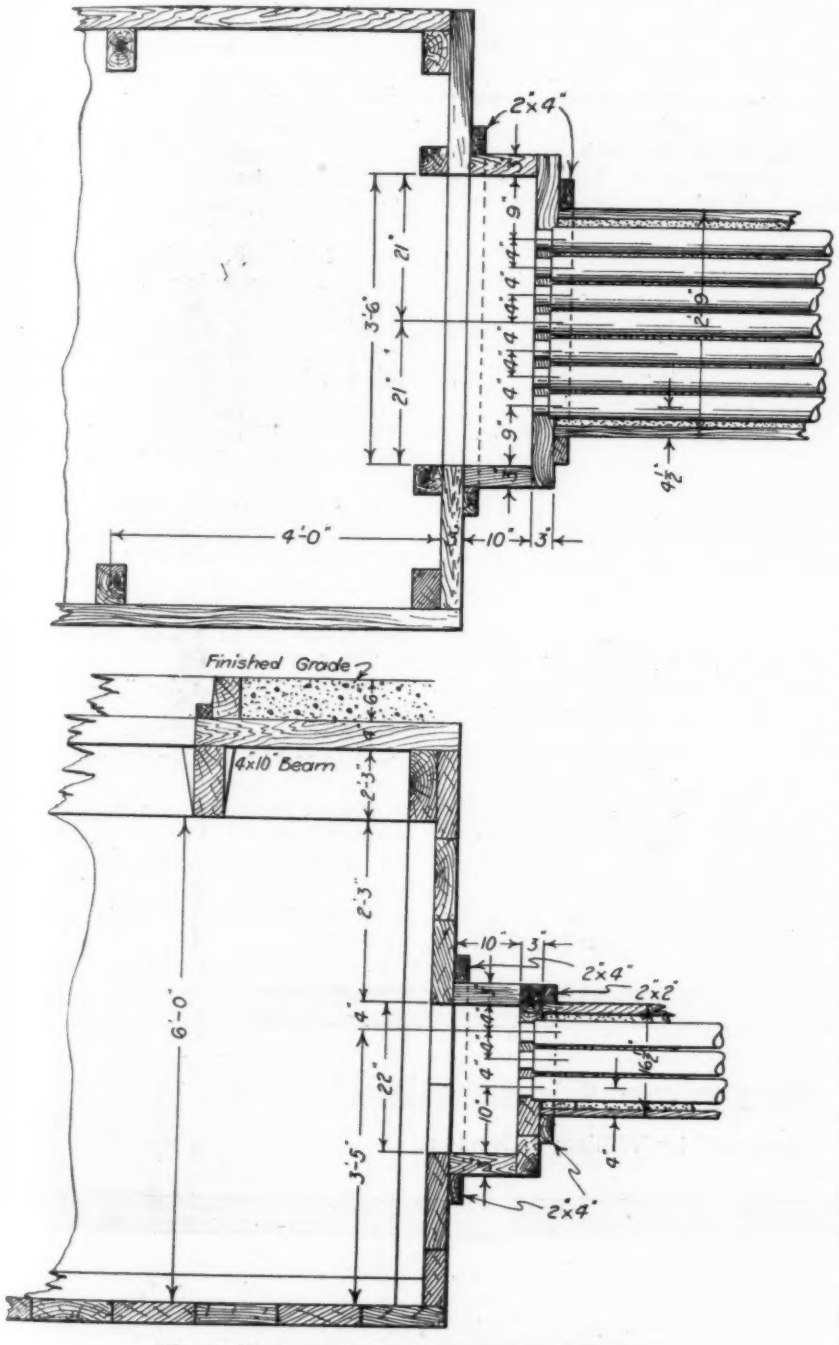


Fig. 4.—Horizontal and Vertical Section of Manhole.

Type of Manholes.

The manholes were built of selected Oregon pine dipped in carbolineum, and were built up in the field, with the exception of the covers, which were constructed in the sawmill. The covers are carried on wooden beams supported on vertical posts at the sides of the manhole. While a number of manholes are situated in the parkings, all covers were designed to withstand the maximum traffic load that could come over them. All the manholes were designed with a flexible neck-piece so as to permit raising and lowering according to the grade, which varied greatly in places, owing to changes in landscape elevations. Some of the manhole necks are as short as 6 inches, while others are as deep as 2 and 3 feet. The conduit manholes were purposely depressed several inches below grade with this in view and in cases where future conditions were uncertain or unknown, greater depression was allowed. The extra long manhole necks were utilized wherever the duct lines had to be depressed to unusual depths, as in the case of railroad tracks entering the exhibit buildings below terrace levels. This effected a considerable saving in manhole construction costs, as it was cheaper to extend the necks to the surface than the full manhole.

Another help toward economy was the type of cable entrances to the manholes. This entrance or wart, as it is termed, consists of a box made up in the shop and having a depth of 12 inches. This box was nailed on the face of the manhole proper at the point where the cables enter. (See Fig. 4.) The outer face of the wart was bored to correspond with the inside diameter of the conduit and

counterbored for a depth of one-half-inch, slightly larger than the outside diameter of the conduit, to provide a thrust for the same and to form a beginning point for the conduit men to commence operations. The procedure followed was to open the trench and to nail the wart at the point of cable entrance, the planking of the manhole having been sawed out previously. The principal economy in the use of warts is that they made the manhole actually constructed equivalent to a manhole two feet longer. The bending of the cable was begun inside the wart and carried around through the manhole and into the other warts. This made possible much smaller manholes and greatly reduced excavation costs.

The type of manhole cover which was installed is a simple wooden cover, dropped into a beveled recess frame which is a part of the manhole neck previously mentioned. This type was used throughout the higher portion of the grounds, where the manholes were of standard depth to comply with existing state laws, which call for five feet clearance. In the State and Foreign Section, where the standing water plane is close to the surface of the ground and where it is impractical to dig to the standard depth owing to the continual flooding, it became necessary to make the covers equal to the full size of the manhole, and in two sections for easy handling. In these sections the manhole is four feet deep and when open, the workers have full clearance above and around them.

The above described conduit plans were followed throughout the grounds with the single exception of the main trunk-line cables between the substation and the main group of exhibit palaces. Due to the quantity of cable employed in these trunk lines, the duct was built in two sections of standard concrete construction for safety, with the exception of the manholes, which were of wood. The cables were niagrated when passing through the manholes. When the trunk lines reached the first group of buildings, practically one-half the cables were run around the main group of buildings on the north side and the other half by way of the south side and the main entrance gates. The gate cables were designed for a two-fold purpose —to provide efficient distribution for the isolated buildings in that section and the illumination units in the South Gardens and to form an additional tie for the State and Foreign Section.

(To be continued.)

Among the Contractors.

The Union Electric Company, of Nashville, Tenn., has the contract for electric wiring in the new Parrish apartment house, which is under construction, and also for a new bungalow being built for Mrs. Eura Lee McLain.

Herbrick & Lawrence, of Nashville, Tenn., are handling the electric wiring in the new Plater residence in that city.

The Hub Electric Company, 1819 Carroll Avenue, Chicago, is distributing brass foot rules containing an inch scale on one edge and upon the other two draftsman's scales of one-eighth inch to the foot and one-quarter inch to the foot. They are very handy and useful rules.

Meeting of Toronto Contractors.

There will be a convention of electrical contractors at Toronto, Canada, September 6, 7 and 8. Meetings will be held at 2 College Street. The following program has been arranged:

Address on "Organization and Its Merits, with Particular Reference to Our Organization," by E. A. Drury, Toronto.

"Licensing of Electrical Contractors. What other cities have got, and how we should work towards getting the License." (Speaker to be selected.)

"Do it Electrically," by Walter Carr.

"Rules and Regulations of the Hydro-Electric Power Commission of Ontario," by H. F. Strickland.

"Proper Accounting System for Electrical Dealers and Contractors." (Speaker to be selected.)

"Workmen's Compensation Act of Ontario as it affects Electrical Contractors," by E. M. Trowern.

"The Possibilities of Advertising in the Electrical Business," by Frank H. Rowe.

"The Relation of the Trade Newspaper to the Electrical Trade and to the Association," by J. C. Armer.

"The Relation of the Jobber to the Dealer and Contractor, and the Jobbers' Function in the Trade." (Speaker to be selected.)

"The Re-Sale Problem," by G. T. Dale.

"Competition from Power Companies and Municipalities," by George W. Hill.

General Discussion and Suggestions.

(a) Consideration of the advisibility of establishing a Provincial Organization.

(b) Making this Convention an annual affair.

Public Service Commissions

Conducted by William J. Norton

IDAHO.

Idaho Traction Company. In holding that the Commission is without authority to require the Idaho Traction Company and the Boise Railway Company to enter into an agreement for the transfer and exchange of passengers, the Attorney General says: "A due regard for the orders of this Commission by those public service corporations over which this Commission has jurisdiction, requires, upon the part of your honorable Commission, a most rigid observance of the limits of that jurisdiction, and in those matters wherein the legislature has clearly not conferred jurisdiction, an assumption of such jurisdiction would argue for a similar disregard of legal and statutory obligations by those companies over which your honorable body is, by law, invested with supervisory powers."

MAINE.

North Yarmouth Water Company. The Commission refused to grant the company's application for authority to issue securities, holding that bonds should not be authorized without a substantial stock margin. The opinion in this case is based on the policy outlined in the Black Stream Electric Company case. (ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 22, p. 955.) From the facts in the case it appears that all of the cash paid in as capital was withdrawn; that the corporation parted with all its tangible assets except real estate, which cost $100, and pipe, etc., not exceeding a value of $300; and that it ceased to do business. The company still holds its franchise, and now seeks

to re-establish its business, and for this purpose asks authority to issue 20-year five-per-cent mortgage bonds of the aggregate amount of $10,000. The Commission says that although the amount involved is small the policy of the Commission should be made clear.

The Commission finds that the company is practically a new corporation seeking authority to secure its entire capital and that the case comes under the policy adopted in the case of the Black Stream Electric Company.

"While the original certificates of stock are still outstanding, the value which they represented has been withdrawn dollar by dollar by their former owners. Except for $400 at most, they now represent no tangible assets. Unless they are vitalized by new money substantially the entire undertaking will be financed from bonds. It is well settled that franchise value cannot be considered as an element in rate-making, and this bookkeeping asset ($3,000) would therefore be valueless any time the question of rates might be raised. The Commission could not permit the petitioner to construct a plant on $6,000 of bonds and exact rates to provide a return on $9,000 of capitalization. So far as the book value of the real estate is concerned, the corporation paid $100 for it. It may have been, and probably was, an excellent trade—might have been at $500. But the accounting rules of this Commission require purchased property to be carried at cost, and, although it was purchased before the Public Utilities Act became operative, considering this in effect as equivalent to capitalizing a new enterprise, we do not think that we ought to deviate from the rule.

"We then have in effect a new corporation with assets capitalizable at $400. All outstanding stock above that represents nothing that can now be considered, or that would give it earning value in the hands of possible future purchasers. This construction is no hardship upon its present owners, because it cost them nothing. Before additional securities are issued all in excess of $400 should be turned into the treasury or made good by the advancement to the corporation of an equivalent amount of cash. Bonds should not be authorized without a substantial capital stock margin.

"If, therefore, the present stockholders will reduce the amount of capital stock outstanding to not less than $2,000 par value and pay into the treasury of the corporation cash for all stock remaining outstanding in excess of $400, at par, the Commission will grant an order authorizing the issue of five-per-cent mortgage bonds sufficient to secure a combined capital of $6,000. when said bonds are sold on not less than a six-per-cent basis."

The case is to remain open a reasonable time pending action of the petitioner on these suggestions.

MISSOURI.

Standards of Service. Rules were issued by order of the Commission, July 10, 1915, for the regulation of gas and electric service, applying to both private and municipal plants. These rules, together with the rules governing water utilities, are printed in pamphlet form and are made effective as of October 1, 1915.

NEW JERSEY.

The Delaware and Atlantic Telegraph and Telephone Company was authorized to transfer on its books $4,728,500 of the capital stock of the Bell Telephone Company of Pennsylvania to the New York Telephone Company. The Bell system in the northern part of the state has been operated from New York and the system in the southern part from Philadelphia. As a result of the transfer of stock approved by the Board the entire Bell system in New Jersey will be operated from New York.

Up to two years ago the Delaware and Atlantic Company also operated a telephone system in northern Delaware. There, as in New Jersey, it was backed by the Pennsylvania company. Following a suggestion by the State Board of Utility Commissioners of New Jersey, the Pennsylvania company disposed of its holdings in the Delaware and Atlantic to the Diamond State Telephone Company, which thus became the sole operating company in Delaware.

The result of placing the Bell telephone system in Delaware in the hands of one company is said to have been an entire success, and also to have been one of the leading factors in the project to bring about a unification of management of the Bell system of New Jersey.

NEW YORK—Second District.

The Central Hudson Gas and Electric Company was authorized to issue $500,000 of 10-year, six-per-cent bonds, in $1,000, $500 and $100 denominations, convertible into common stock on and after October 1, 1918. The proceeds will be expended in making extensive improvements and additions to its plant and distribution system in Poughkeepsie, Newburgh and surrounding territory.

INTERSTATE COMMERCE COMMISSION.

Rock Island Railroad. The report of the investigation of the Rock Island railroad made by the Interstate Commerce Commission charges the railroad officials with misrepresentation in their reports to stockholders and shows losses in stock transactions aggregating more than $20,000,000. The Commission, in severe criticism of the past financial operations of the company, says: "Those guilty of misleading reports to stockholders should be subject to adequate penalties.

"A director of a railroad is a quasi-public official who occupies a position of trust. A director who submits blindly to the exploitation of his company is a party to its undoing, and he should be held responsible to the same extent as if he had been a principal instead of an accessory before the fact. The greater his prominence the greater his responsibility and the greater his dereliction. * * *

"It should be just as grave an offense for an official of a railway to be faithless to his trust for financial gain as it is for an elected official of this Government to betray his trust for a money reward."

Plans for Prosperity Week in Louisville.

Louisville Jovians will have charge of the local celebration of "electrical prosperity week" and have already begun in a small way what will be elaborate preparations by the time the last of November arrives. At the last meeting of the League the movement was started and plans discussed at considerable length.

One of the special things that has been determined upon is that there will be a parade of electrically operated automobiles, in which an effort will be made to enlist every such vehicle in Louisville. At the same time the League will try to interest the merchants of the city, prevail on them to decorate their stores for the occasion and on those who handle electrical things to emphasize them during that week.

One of the practical undertakings in order is a census of the electrical trades of the city. Through Robert Montgomery, of the Louisville Gas & Electric Company, and his committee, an effort will be made to list all those whose livelihood depends upon their interest in one or another phase of the electrical industry. This, it is estimated, would run to perhaps 10 per cent of the total payroll list of the city.

If these facts could be given proper publicity it is believed that the business interests of the city would appreciate the wisdom of making an appeal for the patronage of this element of the population and the element dependent on it.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 296.—High Cost of Rendering Bills.—I understand that in the case of some of the large central-station companies it costs on an average from 16 to 18 cents to render the ordinary monthly bill for current used. What is the reason for this high cost? What efforts have been made to reduce it?—D. L., Chicago, Ill.

No. 301.—Transformer Winding.—What size of wire should be used for primary and secondary winding for a transformer to step down 220 volts to 110 volts, capacity about 10 amperes? Also what quantity of wire of each size should be used? Does any manufacturer carry such transformers in stock?—R. D. F., Corona, Cal.

No. 302.—Air and Electric Rock Drills.—Are electric rock drills used to any extent for preparing holes for blasting in quarries, tunnels and metal mines? How do they compare with air drills? Where air drills are used is it better to supply them from a central compressing plant or from small, portable motor-driven compressors near the place where drilling is being done?—J. B. L., Albuquerque, N. M.

Answers.

No. 295.—Supply Voltage.—Is it customary in the franchises of electrical central-station companies to stipulate what the supply voltage shall be for residence and power customers, or is this left to the option of the company?—K. F. T., Cheyenne, Wyo.

The voltage of supply is rarely specified in a franchise, and then it is for special cases only. The matter of supply voltage is one that is decided by economic conditions, it is an engineering problem and one that can be solved by the use of sound engineering principles. As with so many other matters of a similar nature, the various supply voltages have become more or less standardized, thanks to the manufacturers, the central-station companies and various engineering societies, and those existing today may be said to be the result of the concerted action of the above bodies. For the public, through a franchise, to dictate upon this matter would be very unwise and short-sighted, tending to retard development, resulting in inefficient methods and higher rates for energy.

There are, however, two instances where the matter of voltage is taken up quite frequently. One of these concerns the passage of high-tension lines through the streets of cities overhead, and here a maximum potential is often specified. The other instance is that affecting the quality of the power supply, of which continuity of service, voltage regulation and frequency are important factors, for under this heading it is customary to stipulate that the supply voltage shall not exceed a certain limit above and below normal. Querist should read the book on "Municipal Franchises," by D. F. Wilcox, for it contains a large amount of interesting material about all kinds of franchises, including many of the details included in the franchises of many of the large cities.—K. R., Chicago, Ill.

No. 298.—Gelatinous Battery Electrolyte.—In some types of small storage batteries made especially for use where they are likely to be upset there is used some sort of jelly-like paste instead of the ordinary liquid electrolyte. What is this paste composed of? Does it increase the internal resistance of the battery? What effect, if any, has it on the efficiency, capacity and life of the battery?—C. M., Jackson, Mich.

Electrolyte jelly is made by adding acid to water glass. Water glass is sodium silicate and directions for making it are given below. A jelly electrolyte reduces the capacity twenty per cent, increases the internal resistance, decreases the battery efficiency, but prolongs the battery life and prevents slopping to a considerable extent. This electrolyte was formerly used in all government sparking batteries.

The proportion of jelly to acid is one to nine. For example:

No. Plates	Jelly	Acid
5	35 c.c.	315 c.c.
7	50 c.c.	450 c.c.
9	60 c.c.	540 c.c.
11	90 c.c.	810 c.c.

Water glass can be made in small amounts by crushing small quartz crystals (silicon dioxide) and dissolving the powder in sodium hydroxide. On a large scale it can be made by melting together sodium sulphate, quartz sand, and powdered charcoal. The resultant mass can be dissolved in water. Water glass dries out and in spite of the fact that sulphuric acid is deliquescent and absorbs water from the air, the solution in the batteries should be watched as closely as if it were only ordinary electrolyte.—R. L. L., Minneapolis, Minn.

The writer knows of no storage battery employing a semi-solid or gelatinous form of electrolyte that successfully fulfills the conditions imposed in practice. There are, of course, batteries in use that utilize a jelly-like electrolyte, but it is only in isolated cases; the number in use is so small and the capacity so very limited that they must be looked upon as curiosities rather than commercial products at this time. The ingredients, and the method of manufacturing the paste used in these batteries is not definitely known, it being rather a trade secret.

As compared with a battery using the ordinary liquid electrolyte, the battery using a paste will show lower efficiency, shorter life, lower output for a given weight, and will hold its charge for a shorter time. The chief difficulties seem to be on account of erratic internal resistances, due probably to local temperature changes; comparatively rapid loss of specific gravity; and the inability to hold the charge. To the writer's knowledge a storage battery employing a gelatinous electrolyte was placed on the market on quite an extensive scale by one storage-battery company, but the battery is no longer marketed, the company having gone out of existence.

Large sums of money have been spent in extensive research and lengthy tests by some very large storage-battery companies, here and abroad, in the endeavor to develop an electrolyte that would be capable of replacing that of the liquid form. So far the end sought has not materialized, in that nothing has been found that will meet the practical conditions imposed for any length of time.—K. R., Chicago, Ill.

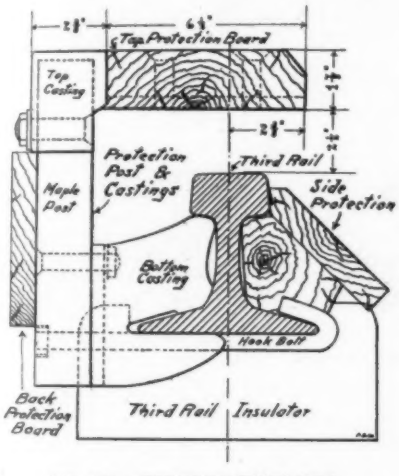
No. 299.—Protecting Third Rail.—What effective means, aside from using the inverted third rail, can be used at highway crossings of an electric railway equipped with the ordinary upright third rail to prevent pedestrians from entering on the right of way at the crossing and coming in contact with the live rail? This right of way is fenced in except at the crossing gaps, where the third rail is interrupted and cattle guards are provided at each side of the crossing.—W. R. A., Elmhurst, Ill.

On the West Jersey & Seashore Railroad the third rail throughout is of the standard cross-section and composition. The rails are in lengths of 33 feet, weigh 100 pounds per yard, and have a conductivity about equal to that of a copper rod of 1,200,000 circular mils area. The third-rail end approaches are made of cast iron. In order that no special insulator need be made to support the end a cast-iron "chair" is used which is designed to fit the regular insulator and to center and hold the end approach thereto. The side approach, used at cross-overs, consists of a plank mounted at an angle on the side of the rail.

At grade crossings and other places where a break occurs in the third rail, each rail is joined electrically by a cable jumper of one million circular mils area. The cable is drawn into a black bituminized-fiber tube, which is laid in a solid concrete protection, the stub end of the cable being connected to the rail by two bare copper bonds. A concrete hood fits over the top of the cable terminals.

Originally the third rail was equipped with protection only at stations, 75 feet on either side of road crossings, and in terminal yards, the construction being shown in the accompanying diagram. The bottom casting is attached to the rail by a hook bolt, which supports the whole protecting structure. A maple post, attached to the bottom casting by a bolt, supports the top casting, to which are bolted the ends of adjacent top-protection boards of two-inch plank, which average seven feet in length, this distance therefore being the spacing of protection supports at stations. At end approaches the top-protection board extends slightly beyond the last support; therefore the top casting here is modified by eliminating a part of the vertical web. The bottom casting is also modified to fit the end-approach casting. The wood used in the original protection was not treated in any way except by being given several coats of paint after installation; that used in later installation was given two coats of hot creosote.

The present method of mounting and protecting third rails on station platforms



No. 299.—Protected Third Rail.

and certain crossings on the B. & O. R. R. is a good one, but even a brief description would be too lengthy here. Some idea can be gained of this method in the *General Electric Review* of November, 1914.—P. B. W., Verbena, Ala.

No. 300.—Fire-Extinguishing Materials.—How do sawdust and carbon-tetrachloride compare with each other and with water and with sand for extinguishing fires in varnishes, transformer oils, etc.? How do the two substances first named act to quench a fire?—H. D., Chicago, Ill.

Water, sawdust, sand and carbon-tetrachloride are all good fire-extinguishing agents, but their efficiency depends largely upon the circumstances under which they are used. Water may be used satisfactorily, if it is miscible with the burning liquid. Varnishes and transformer oils do not fall in this class and, as a general rule, water cannot be used if they should happen to take fire. However, if only a small amount of oil is on fire and there is available a large amount of water, the cooling effect of the large volume of water may be sufficient to extinguish the flame.

To extinguish burning oils it is customary to resort to a smothering effect rather than a cooling effect. Material is used which forms a sort of blanket over the burning liquid, thus excluding the air and causing the flame to become extinguished from a lack of oxygen. This blanket may be either a solid or a gas.

Sawdust and sand come under the head of solid blanketing materials. Sawdust is particularly well adapted for use in extinguishing burning varnishes and oils. The material floats on top of the burning liquid and keeps the air removed. The sawdust itself may take fire, but this does not matter since sawdust burns without flame and at too low a temperature to do any harm. It is good practice to mix a quantity of sodium bicarbonate with the sawdust. This mixture is non-inflammable and gives excellent results.

Sand is also used to extinguish fires by "smothering" the flame. It cannot be used, however, where a tank of oil has taken fire for the simple reason that it will sink to the bottom of the liquid. If oil which has been spilled on the floor takes fire, sand may be used quite effectively to extinguish the flame.

Carbon-tetrachloride operates in two ways as an extinguisher. Its vapor is quite heavy and when the liquid is poured or sprayed over burning oil the heavy carbon-tetrachloride vapor settles down and acts like the sawdust blanket. It also mixes well with most oils and if a sufficient amount of the tetrachloride is used it will render the liquid non-inflammable. The use of this agent is widespread and it is regarded as a very efficient means of extinguishing burning oils and varnishes.

Ranking these extinguishing agents according to their value for use on burning oils, the writer would arrange them as follows: 1. Carbon-tetrachloride. 2. Sawdust mixed with sodium bicarbonate. 3. Sand. 4. Water.—C. A. B., Cleveland, O.

In order to successfully extinguish oil and varnish fires, it is necessary to employ a method that will shut off the supply of oxygen in air sufficiently so that combustion cannot be maintained, rather than attempt to lower the ignition point of the substance in question, as is done when water is used. The most economical means to be used will be determined by the quantity of oils or varnish which are to be treated. However, in any case, a blanket is to be formed over the fire. This blanket may be simply a mechanical one, such as a close fitting cover suspended by easily fusible links which melt and allow it to fall and cover the container; sand or sawdust thrown on in sufficient quantity will produce the same result. The fusible-linked cover is standard practice approved by the Underwriters, and, if conditions will permit of its use, is to be preferred to the sand, etc., for the reason that it is difficult or expensive to separate these by filtration or precipitation, unless the quantities are so limited that their cost may be neglected and recovery unnecessary; this method will serve because the materials cost nothing.

Carbon-tetrachloride will give good results by reason of the gases evolved spreading over a larger area and hence being more effective than the sand, etc. This requires but a low cost of installation, when manual operation is resorted to, and need not necessarily be applied under pressure, although if so used or sprayed it is naturally more effective. Carbon-tetrachloride has an advantage over the regular fire extinguishers employing an acid and alkali in water solution producing CO_2 gas delivered under pressure created by effervescence, in that it is a non-conductor of electricity and may be safely used on conductors carrying current. There are extinguishers on the market which employ carbon-tetrachloride as the base of the extinguishing materials.

It is very easy and interesting to demonstrate the blanket effect of CO_2 gas by the following experiment: To a small quantity of bicarbonate of soda add a little sulphuric acid; pour the gas evolved into a deep saucer in which has been previously placed a small piece of lighted candle, and note that as the gas covers the flame it is promptly extinguished.

When oils in large quantities are to be extinguished, carbon-tetrachloride may be pumped to the container and delivered over the burning surface. A very quickly effective method is to charge the room containing the oil, etc., with live steam; this is supplied through a system of piping that is in reality a duplicate of what is known as a dry sprinkler system, but with the exception that the sprinkler-head seals have been removed and are normally not under pressure, a controlling valve being located well out of the danger zone.

If the fire in question is in such an exposed location that the blanket cannot be maintained but is dissipated by air currents, etc., the above methods will not avail. The latest practice in this connection is to use a foaming soap solution applied in the same manner; this has proven successful under varying adverse conditions. Reports of tests on both methods can be obtained from the National Fire Protection Association.—M. K., Passaic, N. J.

Coal production in Iowa in 1914 showed a decrease of 1 per cent as compared with 1913, the output in 1914 being 7,451,022 short tons, valued at $13,364,070.

The Lighting of Rifle Ranges.

At the annual meeting of the Illuminating Engineering Society in London there was an interesting discussion on the lighting of rifle ranges.

This discussion was opened by A. P. Trotter, himself a member of the City of London National Guard Volunteer Corps. In modern warfare, and in rifle shooting, especially, vision plays a great part. The question was raised whether the conventional methods of artificial lighting for rifle ranges are the best adapted to training men for shooting in the open, where the conditions of lighting are totally different, and some of the points raised have decided interest both to illuminating engineers and to musketry instructors, many of whom were present at the meeting. In the course of his remarks Mr. Trotter alluded to various difficulties experienced particularly by elderly men, in seeing the sights of the rifle. These difficulties seem to be connected with the method of lighting. Mr. Trotter found that he could obtain much better results on an open-air range, and he therefore set about designing a system of artificial lighting which approached more nearly to open-air conditions. It was pointed out by several speakers that an extreme contrast between the illumination of the target and the relatively dark surroundings is a drawback. This conclusion seems in agreement with some of the work carried out in this country by Dr. Cobb, and seems to be partly attributable to the fact that the dark surroundings open up the pupil aperture to an abnormal extent and accentuate defects of vision.

In most rifle ranges the men fire from a situation in almost complete darkness down a "tunnel," the brightly lighted target being at the far end. In these circumstances it is possible to over-light a target, and from experiments made by Blok, Clark and others in London, an illumination of the order of 50-foot candles is sufficient to cause a distinct effect of glare, rendering the sights and the bull's eye indistinct. In the open, however, apparently on account of the adaptation of the eye to the general brightness, men find no difficulty in aiming at a target illumirated with hundreds or even thousands of foot-candles.

The plan adopted by Mr. Trotter, in conjunction with Mr. Brazil, is shown in Fig. 2. The target is viewed through apertures in a series of white illuminated screens, the brightness of which may be slightly less than that of the target. In this way the great part of the retina is occupied by an image of moderate brightness and the undesirably high contrast is avoided. Some experiments with this system have already been made, and so far it appears that distinctly better results are obtained.

In the course of the discussion particulars of a large number of ranges in London were given by A. Blok, who suggested that for ordinary targets an illumination of 12 to 15 foot-candles is comfortable, while for pictorial targets 20 to 30 foot-candles may be allowed. Naturally no unscreened sources of light should be visible, the local lamps used for the target being always covered with appropriate reflectors. Several speakers pointed out that it would be an advantage for the firing point to be illuminated to some extent, partly because this enables the instructor to see the attitudes of men firing and partly because it facilitates clear vision.

The chief reason given for the present system of firing from a point in complete darkness is that inconvenient reflection of light from the sights must be avoided. It was pointed out, however, that such reflections are usually caused by the presence of naked lamps, and would not occur if well diffused indirect lighting was employed. Another important point is the color of the light used for pictorial targets. Many of these have hills, fields, etc., in light green and orange, and it becomes quite difficult to distinguish objects if they are illuminated by an old and dirty incandescent lamp which gives a dull and yellow light.

Several speakers expressed themselves as in favor of the "orthoptic" sight (in which observations are made through a fine pin-hole). This appears to act like the stop on a camera, improving the eye lens and giving sharper definition. On the other hand the use of a pin-hole naturally means the loss of a considerable amount of light, so that the method may not be so applicable when the objects looked at are only faintly illuminated.

Fig. 1.—Conventional Method of Lighting Rifle Ranges.

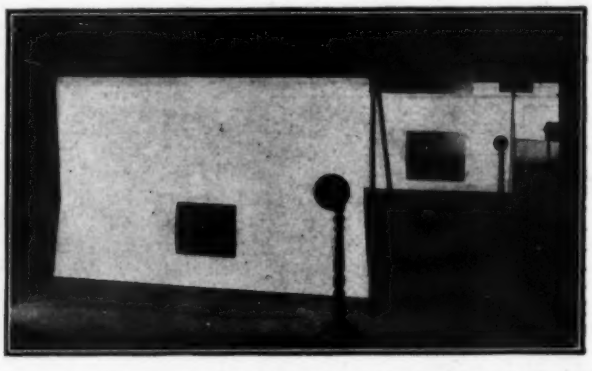


Fig. 2.—New System of Arranging Lighting Suggested by Messrs. Trotter and Brazil.

Electrical Exports to South America.

During the month of July, 1915, electrical supplies were exported from the port of New York to the various countries of South America in amounts reaching the following values: Argentina, $24,940; Brazil, $38,814; Chile, $16,307; Colombia, $24,333; Peru, $7,422; Uruguay, $3,601; Venezuela, $8,376; all other countries, $3,591.

The values of electrical machinery exported during the same period were as follows: Argentina, $9,550; Brazil, $2,239; Chile, $12,709; Colombia, $1,874; Peru, $1,293; all other countries, $1,717.

Copper wire was exported in the following amounts: Argentina, $15,126; Brazil, $12,456; Chile, $4,237; Colombia, $2,880; Peru, $1,544; Uruguay, $637; all other countries, $896.

As about 85 per cent of the exports from this country to South America go from the port of New York, these figures will give a good idea of the electrical exports from this country.

Correction.

In the article entitled "Test of a Direct-Current Motor" in the issue of August 7, typographical errors appeared in two of the formulas.

In the middle column of page 241, 14 lines from the bottom, the expression for the I^2R loss in the armature should read

$$W=2r/n(I/2n)^2 2n.$$

In the first column of page 244, twenty-third line, the diagonal line separating the numerator and demoninator has been omitted. This equation should be

$$R/R_1=R_0(1+0.0042t)/R_0[1+0.0042(t+r)].$$

AUXILIARY STEAM PLANT OF THE VANCOUVER ISLAND POWER COMPANY.

By H. W. Beecher.

This article describes the mechanical features of a modern steam plant designed primarily for burning oil, but with the possibility of substituting coal for fuel. It typifies present practice on the Pacific Coast including automatic regulation of the fuel.

The development of water power along the Pacific Coast by various public service corporations has brought to light the fact that a steam plant as an auxiliary is almost a necessity. At any rate the development companies have usually completed the installation by adding a steam auxiliary with a considerable percentage of the capacity of their entire equipment. To insure continuity of service and protection of their customers, one by one the companies have installed these steam plants, or so multiplied their distribution and hydroelectric properties as to prevent shut-down of their systems by the disablement of any one of their hydroelectric plants or their transmission systems.

The combination of the necessity for the speedy installation of additional capacity and the advisability of putting in a steam power plant as an auxiliary to its system was responsible for the Vancouver Island Power Company, Limited, installing at Brentwood Bay, B. C., near Victoria, one of the finest steam turbine plants in the Greater Northwest. The installation was made during the summer of 1912.

The company had in operation at that time its hydroelectric plants at Goldstream and Jordan River. The Jordan River plant was placed in operation in the autumn of 1911, thus increasing the capacity of the system by 8,000 kilowatts, but nevertheless, the load continued to grow at such a rate that this increase appeared to be inadequate to meet the probable demands of the load carried in the winter. Owing to lack of time, further additions to the hydroelectric plants could not be made, therefore the installation of the steam power plant as an auxiliary was decided upon. A remarkable coincidence occurred within one-half hour after the first unit of the steam plant had been phased out and pronounced ready for operation by the contractors. The Jordan River plant, which had been running for some two years without shut-down or failure of transmission line, ceased operation through transmission troubles, immediately necessitating the commercial use of the new unit of the steam auxiliary.

The problem of locating the new steam auxiliary was by no means an easy one. At this time the city of Victoria was enjoying a real-estate boom which showed prospects of being prolonged indefinitely. This condition of affairs naturally made the price of inlying water-front property prohibitive. A careful investigation of the various sites taken in connection with the location of power load resulted in the proposed plant being installed at Brentwood Bay, on Saanich Inlet, and the installation of the combination of steam auxiliary and substation for transmission of direct current for use on the Saanich interurban, owned and operated by the British Columbia Electric Railway Company, Limited, which controls the public utilities of

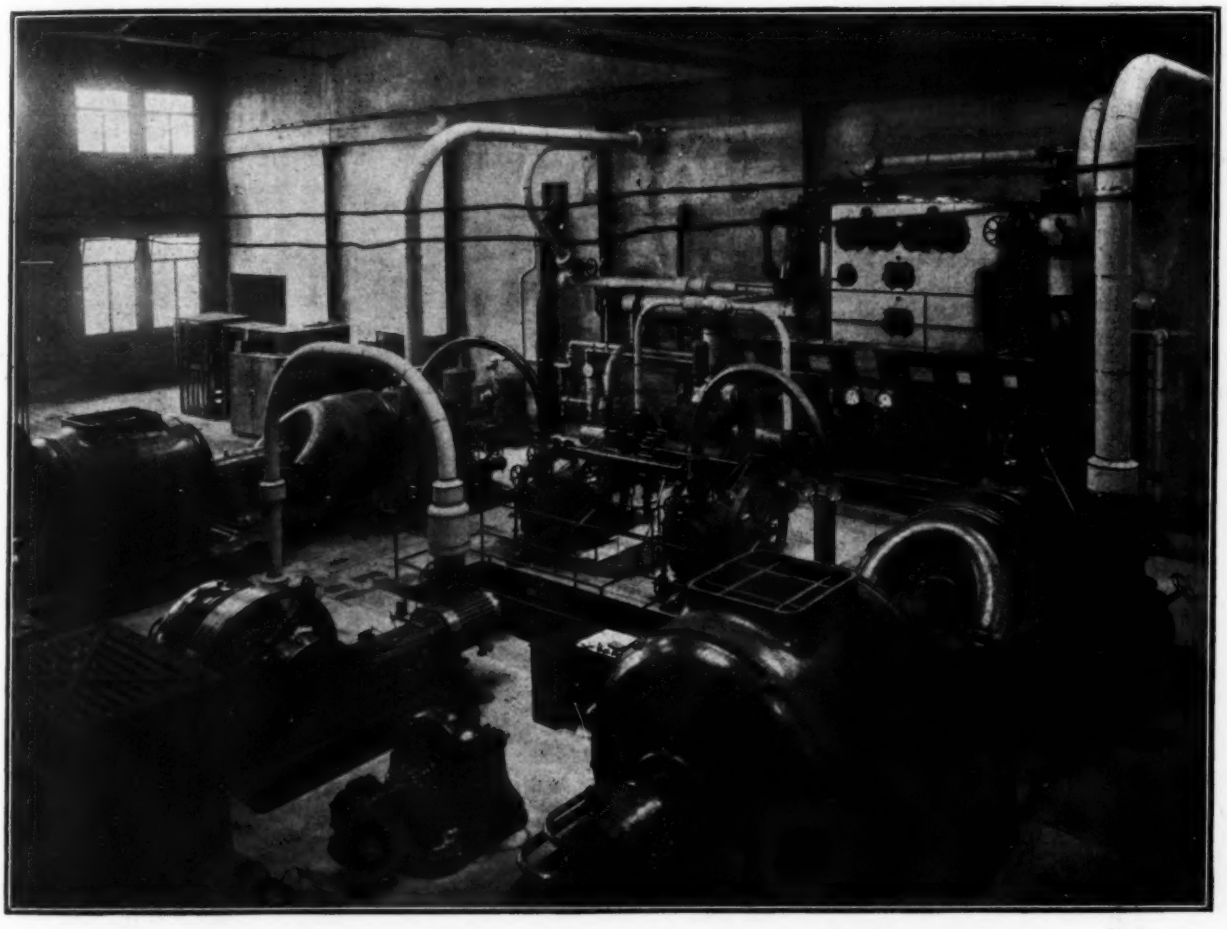


Fig. 1.—Turbine Room of Vancouver Island Power Company, Limited.

Vancouver, New Westminster, Victoria, and their immediate vicinities. The Vancouver Island Power Company is a subsidiary of this corporation.

From a study of the territory to be served, with respect to distribution of load in relation to the interurban requirements and with regard to the location of transmission lines, it became evident that the plant should be located as near as possible to the Vancouver Portland Cement Company and the Bamberton Portland Cement Company, as well as near the middle of the transmission line. Both of these cement companies depend upon the Vancouver Island Power Company for their power. It was of equal importance to have location within suction limits and in close proximity to ample supply of deep water, both for condensing purposes and to simplify the handling of fuel, either oil or coal, from barges or cargo steamers. The site at Brentwood Bay, on Saanich Inlet, is about 12 miles north of Victoria and near the tracks of the Saanich Interurban line, of the British Columbia Electric Railway Company.

The wharf permits of the landing of the largest oil tank steamers for delivery of their cargo with ease and safety.

The site of the power plant, when work first started in June, was covered with a luxuriant growth of virginal timber, as is shown in some of the illustrations. The timber had to be cut and removed, the undergrowth grubbed out, the stumps bored and blown up and the refuse collected and burned. The overburden at the site of the plant averaged about two feet thick, and amounted to about 3,500 cubic yards. The underlying rock was a shattered formation of igneous nature and weathered rapidly. The land slopes rapidly up from the shore, involving a considerable cut on the back portion, in order to bring the plant within proper suction limits, and not impose too much head on the circulating pumps. The excavation involved the blasting out and removal of considerably over 27,000 cubic yards of material.

In order to provide easy facilities for the storage and handling of coal, should such fuel be adopted, and also to secure suitable foundation for the concrete chimney, it was decided to run the boiler room alley perpendicular to the shore line.

As soon as a working space was secured, portable track and side-dump cars of one cubic yard capacity were employed. These were filled by hand with shovel and ran by gravity to the dump. By tunnelling and loading a cross-cut, large shots were set off, breaking down many yards of the fractured rock at each charge.

It was necessary to establish a camp and about forty tents were put up, laid off on temporary streets, with cook-house properly located. The preliminary work was driven ahead, night and day shifts being employed. Machinery began to arrive before the foundations were in place, and the plant was ready for operation before November 1, less than five months in all being consumed in the construction of the plant.

In laying out the plant, it was decided to provide for two rows of boilers, with a firing alley between as will be noted from the accompanying illustration. The power plant is of steel-frame construction, with reinforced concrete curtain walls, and consists of three bays, 137 feet long, housing the boiler room, turbine room, and transformer station. The bays are 93 feet 4 inches, 69 feet 11 inches and 50 feet 8 inches in width respectively, as shown on the general plans. While the elements of economy and simplicity were given first consideration, a decidedly pleasing architectural appearance has been maintained throughout, and the permanent building has been completed of suitable size to house the ultimate capacity of the plant. This was done for economic reasons, as the plant was so far away from Victoria that construction work had to be done by means of camps, and it was deemed advisable to complete the entire building at once.

The structural steel for boiler room is of sufficient strength to support overhead bunkers, suspended between the boilers, should it ever be desired to use coal fuel, and the head room of boiler room and location of columns has been laid out with this in mind.

Near the roof of the building, at such points as to give a maximum of light, windows of liberal size and frequently spaced have been distributed around the building, in the curtain walls. In addition to the lighting secured in this manner, the tar and gravel in the roof of the building is broken by a considerable number of skylights, suitably distributed. These skylights are fitted with louvres, so as to provide ample ventilation, as shown plainly in Fig. 2. This illustration also shows the temporary lightning arresters, and high-tension distributing lines, with the steel towers for the permanent lines prominent in the foreground. More will be said about these later, in the description of the transformer station.

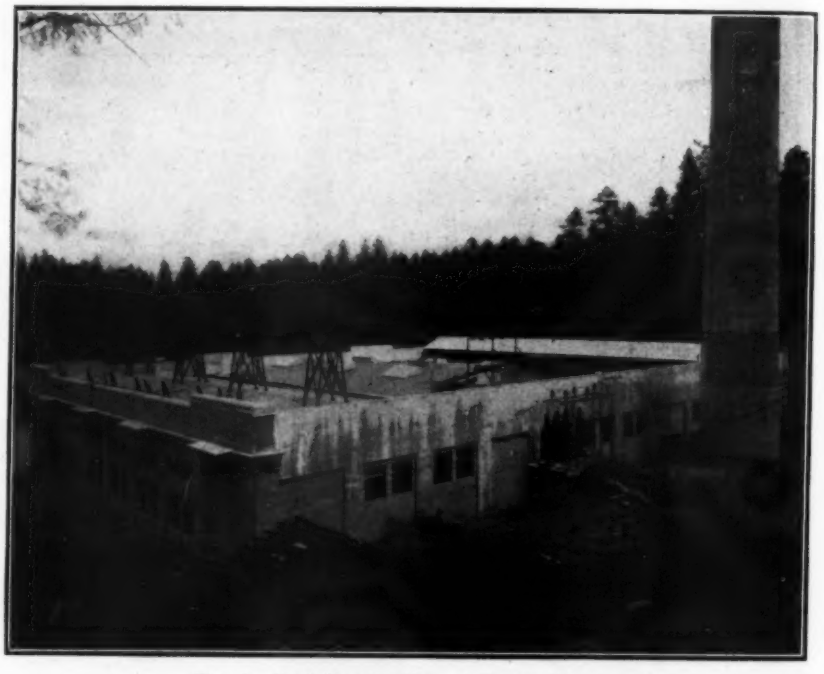


Fig. 2.—Roof Construction of Power House.

No attempt was made to crush and use the native rock, either for foundation, concrete or in the wall, and all concrete walls are made up of an aggregate consisting of high-class washed gravel. The concrete walls have been given a 0.75-inch cement-plaster finish, which sets off very nicely the architectural effect desired.

The main doorways in the building are of ample size for the passage of any machinery which may reasonably be expected to be used in connection with the plant. These doorways are

closed by large sliding doors, having wicket or man doors for the ordinary passage of the operators.

In Fig. 3 is shown the circulating discharge piping and on the extreme right the circulating water inlet tunnel, with its retainng wall, and just to the left of it. the remnants of the grid apron, up which most of the machinery was taken from scows.

The present plant consists of six Babcock & Wilcox patent safety water-tube boilers, of forged-steel construction, arranged in three batteries of two boilers each. Provision has been made in the building for the installation of ten additional boilers, making a total of sixteen. These boilers were built by Babcock & Wilcox, Limited, of Glasgow, Scotland. Each

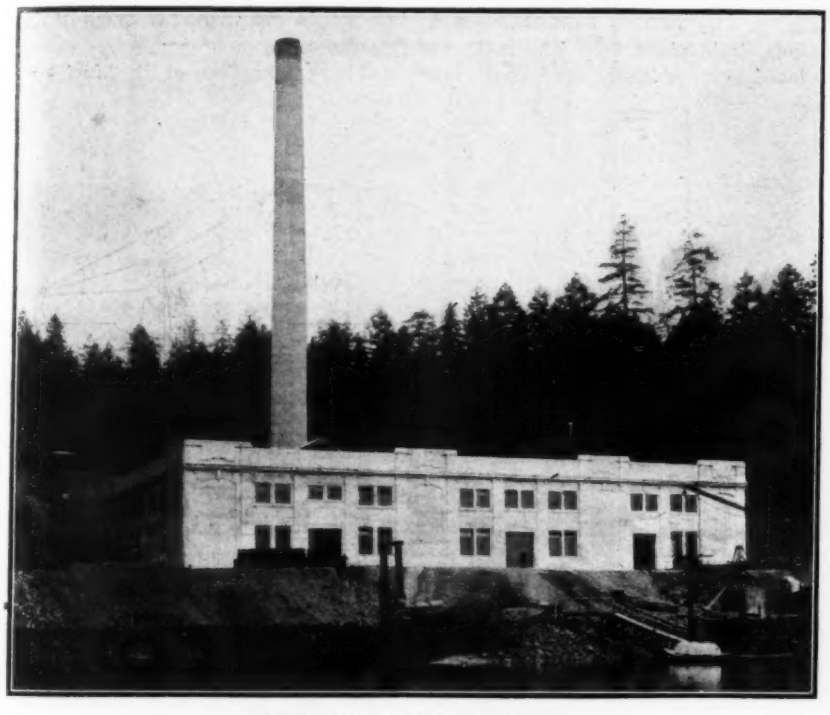


Fig. 3.—Completed Power House.

boiler consists of 18 sections, each having 12 four-inch tubes, 18 inches long, over which are mounted two steam and water drums, 46 inches in diameter, and 24 feet, 3 inches long. The total water heating surface of each boiler is 4,780 square feet. The boilers are designed for a working pressure of 200 pounds per square inch, and are in accordance with the standard construction of the Babcock & Wilcox Company, for the above pressure. These high-pressure boilers make possible the use of 180 pounds steam pressure, at the turbine throttles, with the attendant economy features.

Each boiler is equipped with one Babcock & Wilcox forged-steel superheater, designed to give from 80 to 100 degrees Fahrenheit superheat, at the boiler nozzle, when using California fuel oil. If coal is adopted as a fuel, special baffling will be necessary to prevent excessive superheat, as the same amount of surface is not necessary for coal as for oil fuel.

Each boiler is provided with a Peabody patent fuel-oil-burning furnace. The furnace is fired from the bridge wall forward, but is controlled at the boiler front. The distribution of flame is over a large area of boiler-heating surface, preventing localization of heat and blow-pipe action, and minimizing the possibility of burning out tubes. The furnaces are arranged for the use of three burners per boiler.

The burner connections through the ash-pit doors are shown in Fig. 6.

The boilers are set with eight-foot furnace height, and the ash-pits have been temporarily filled in, and the ash tunnels installed so that the boilers may later be converted to coal stoker feed, with a minimum of expense or delay. The method of handling the ashes corresponds with that which was installed in the Electric Company's plant in Vancouver, by the same firm of contracting engineers, and which gave such satisfactory service prior to the conversion of that plant to oil fuel.

The steam turbo-generators installed are of Allis-Chalmers manufacture. These turbines are of the well known Parsons reaction type, with certain modifications. Principal among these are: the system of balancing, the shroud ring over the tips of buckets, the governor, and the packing on low-pressure end. The generator is of the well known design for generation of three-phase alternating current, at 2,300 volts. The combined units operate at 1,800 revolutions per minute.

For excitation purposes, a 75-kilowatt, 125-volt, direct-current generator, direct-connected to a simple side-crank, non-condensing, inclosed, self-oiling, automatic engine, built by A. L. Ide & Sons, is provided. This exciter is placed between the main units. The engine is designed for the same pressure and superheat as the main units, and it operates very satisfactorily, under these conditions of service. One 75-kilowatt, 125-volt, direct-current generator, direct-connected to one 110-horsepower, three-phase, 60-cycle, 2,300-volt induction motor, is also provided for excitation purposes, for use at light loads, when the use of the steam-driven unit would cause an excess of auxiliary steam over that required for the heating of the feed water, with its attendant loss of economy. These generators and motors were supplied by the Canadian General Electric Company.

Each turbine exhausts directly through a corrugated copper expansion joint, into a Wheeler Admiralty surface condenser, of the dry-tube type. Each condenser contains 4,000 square feet of cooling surface. The tubes are brass, 0.75 inch in diameter, No. 18, B. w. g. The dry plates in the condenser drain off the water of condensation, as it is formed, and allow it to fall to the bottom of the condenser, where it is withdrawn by the hot-well pump. This arrangement prevents the condensation which takes place in the top portion from drowning the lower tubes, thus increasing their rate of conductivity. At the same time, the temperature of condensation is increased, the temperature of the air-pump suction reduced, and the quantity of circulating water required is diminished. The low temperature of the air-pump suction decreases the volume of air to be handled, thus reducing the necessary displacement.

One Wheeler patent rotative dry vacuum pump, of the Yoke frame crank and flywheel type, is furnished with each condenser. These pumps are of the flashport valve type, by which the air compressed in the clearance is automatically transferred to the vacuum side of the piston, prior to starting the return stroke. This reduces the effective clearance to a minimum, and increases the volumetric efficiency to a maximum. There is also furnished with each condenser, and placed directly under it, one cast-iron hot well, with a direct connection to a 2.5-inch special Wheeler centrifugal hot-well pump. These pumps are brass fitted,

have specially constructed passages to give easy access to the throat of the runner, and each is driven by a 7.5-horsepower Kerr steam turbine, operating at 2,400 revolutions per minute.

Three 14-inch Wheeler centrifugal circulating pumps are installed. These are brass-fitted throughout. Two of these pumps are direct-connected to, and driven by, Kerr steam turbines; the third pump is motor-driven. Each pump is of the double-suction balanced type, and draws its water from a pump pit, located directly below and which will later be described. The water is discharged through individual multiple-disk check valves.

All of the above condensing apparatus, consisting of condensers, air pumps, hot-well pumps, and circulating pumps, was furnished by the Wheeler Condenser & Engineering Company.

Two Warren horizontal duplex simple steam-driven boiler-feed pumps, mounted on cast-iron drip pans, are provided. The pumps operate non-condensing, each pump being of ample capacity for the present plant, the other being in reserve.

One open-type feed-water heater is provided. This heater receives the hot-well pump discharge and make-up water at the top, and distributes it over iron trays, from which it falls in a finely divided spray. The auxiliary exhaust is passed through this spray, condensing it and at the same time imparting its heat to the feed water. Ample storage space is provided in which to care for the ordinary variation in water level, in the heater reservoir, due to fluctuation of load. The supply of auxiliary exhaust-steam available can be regulated by the use of either steam or motor-driven circulators, as may be required, so as to obtain a maximum temperature of feed water, and at the same time, utilize all the auxiliary exhaust without waste.

In the pump pit has been installed an Underwriter's fire pump, fitted for salt water and connected to a hydrant system throughout the plant. This pump is of the multi-stage centrifugal type, manufactured by The Platt Iron Works Company, and driven by a Kerr steam turbine, of suitable power and speed. The pump has a capacity of 750 gallons per minute, against a pressure of 100 pounds.

Located about 500 feet away from the plant, and at an elevation above it, two steel oil tanks, each of 5,000 barrels capacity, are provided. Each of these tanks is fitted with the necessary connections for filling and emptying, besides heating coils, smothering pipes, drain pipes, etc. The tanks are placed on specially prepared sand foundations, and have been surrounded by earth embankments of such diameter and height as to contain 1.5 times the contents of the tank. These embankments are a safety feature, providing against possible failure of the tanks. These tanks are provided with metal covers, with access doors, and permanent ladders inside and outside. A specially constructed filling pipe provides means by which the tanks are filled from either oil barges or tank steamers. This filling pipe extends to the south of the plant, and down on to and along the face of the wharf, and is fitted with a number of outlets, onto which the oil tank steamers can make connections. The wharf is so laid out as to allow the oil tank steamers to approach it with the least possible difficulty.

The oil pumping equipment, by which the burners are fed, is not directly connected to the main oil-storage tanks. For daily use, two 600-barrel auxiliary oil tanks are provided. These are made of reinforced concrete. The ground was excavated to receive them, below the level of the boiler-room floor, and they are built side by side. The tanks are fitted with the necessary measuring devices, filling pipes, oil suctions, smothering pipes, heating coils, manholes, etc.

These auxiliary oil tanks are shown in Figs. 4 and 5. The pipe coming down from the main storage tank, and the gauges by which oil in the auxiliary is measured, are seen to the left of the building in Fig. 3. "No Smoking" signs are prevalent about certain portions of the plant, where there might be danger due to the presence of combustible gas.

The combustion of the fuel oil is automatically controlled by the Moore automatic fuel-oil regulating system, invented by J. R. Atchison and C. R. Weymouth. In this system, the fuel oil is pumped to the burners under pressures varying from 10 to 50 pounds per square inch, depending on load conditions, there being a uniform pressure throughout all portions of the plant, all burners being wide open or nearly so. The amount of oil burned, with variation of load, is controlled by the pressure of oil at the oil pumps, the intensity of fire increasing and decreasing in all boilers simultaneously. The oil pressure is automatically controlled by steam-pressure regulator, the variations in oil pressure and in intensity of fire being such as to maintain a uniform steam pressure on the plant.

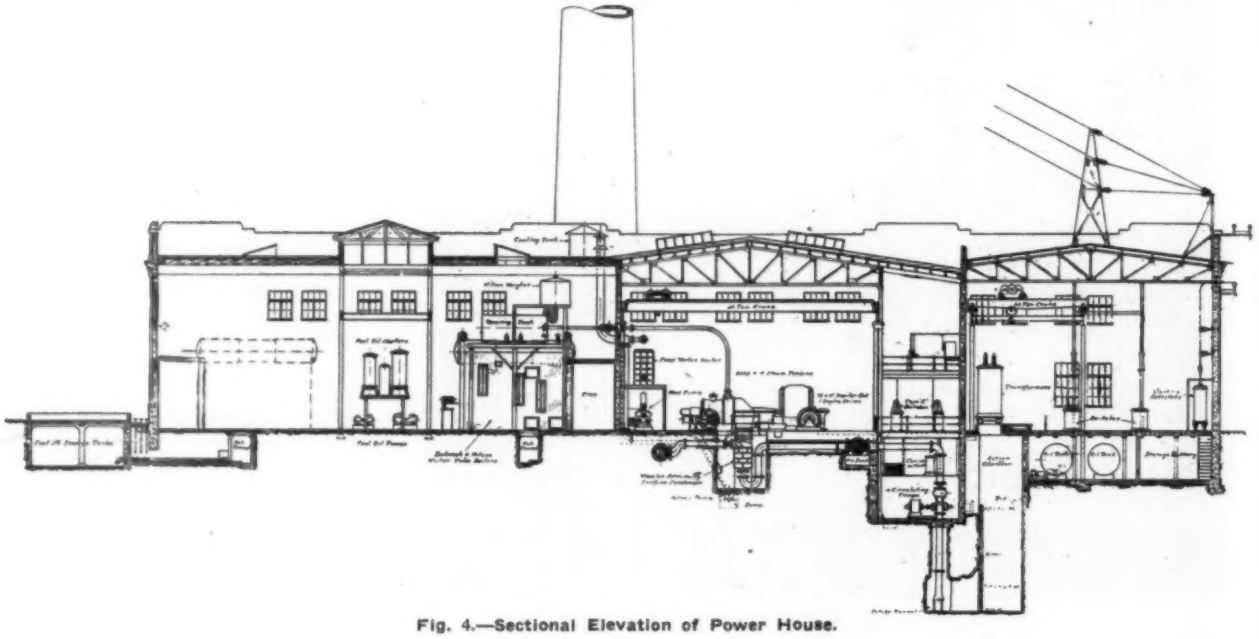


Fig. 4.—Sectional Elevation of Power House.

For atomizing purposes, steam is supplied to the oil burners by a separate low-pressure main, the pressure in this main being automatically controlled by variation of the oil pressure in the oil main. A ratio regulator is used, automatic in its action, which maintains such steam pressure in the low-pressure steam main as is necessary for atomizing the particular amount of oil burned, corresponding to any momentary oil pressure.

The air supply for combustion is controlled by a damper controller, also automatic in its action, which increases the damper opening with an increase in oil pressure, and vice versa. The movement of the controlling lever is governed by the action of the oil pressure on a diaphragm. This movement is opposed by the action of a spring, so that the amount of motion on the main lever is proportional to the oil pressure. This movement is multiplied through a hydraulic cylinder, connected to a rock shaft running over all of the boiler in one panel. Each boiler damper is connected to this shaft, and the connecting levers are set at such angularity, with respect to the connecting rods operating the dampers that the proper air supply is provided over the entire range of load, the final adjustment being from actual trial at the plant.

In actual operation and test, it is found that this automatic system of control is safe, reliable, and meets with the approval and hearty endorsement of the firemen. Owing to the fact that the firemen's work is very much simplified by the use of these regulators, they are as much desired by the firemen of the plant as by the management. Were it not for this accord, such automatic contrivance could not be successfully installed and operated.

On completion of the ultimate plant, the boiler-room main steam piping will form a complete ring with properly located isolating valves. All main steam piping is made up with an improved type of Van Stone joints, and fittings are avoided by the use of welded nozzles. Special anchorages are provided on the columns of the buildings, and liberal bends are used to take up expansion and contraction. Between anchorages at proper intervals, heavily constructed sliding supports are installed. No cast-iron fittings are used on superheating steam lines, and all flanges and bolts are constructed with the idea of making an especially tight system of piping. Following the latest practice, no valve is placed between turbine and condenser, and should it be desired to operate the turbine non-condensing, the steam passes through the top portion of the condenser to the atmospheric exhaust valve. Experience has shown that the conditions under which it might be necessary to operate in this manner are so remote that consideration need not be given to them in comparison with the losses incidental to the air leaks prevalent when using the valve and necessary fittings.

All high-pressure steam piping is covered with an extra thickness of 85-per-cent carbonate of magnesia sectional covering. Covers for valve bodies and flanges are also provided throughout. The effect of this heat insulation has been to reduce the attendant pipe radiation to a minimum. This is particularly desirable in an auxiliary plant, on account of the long

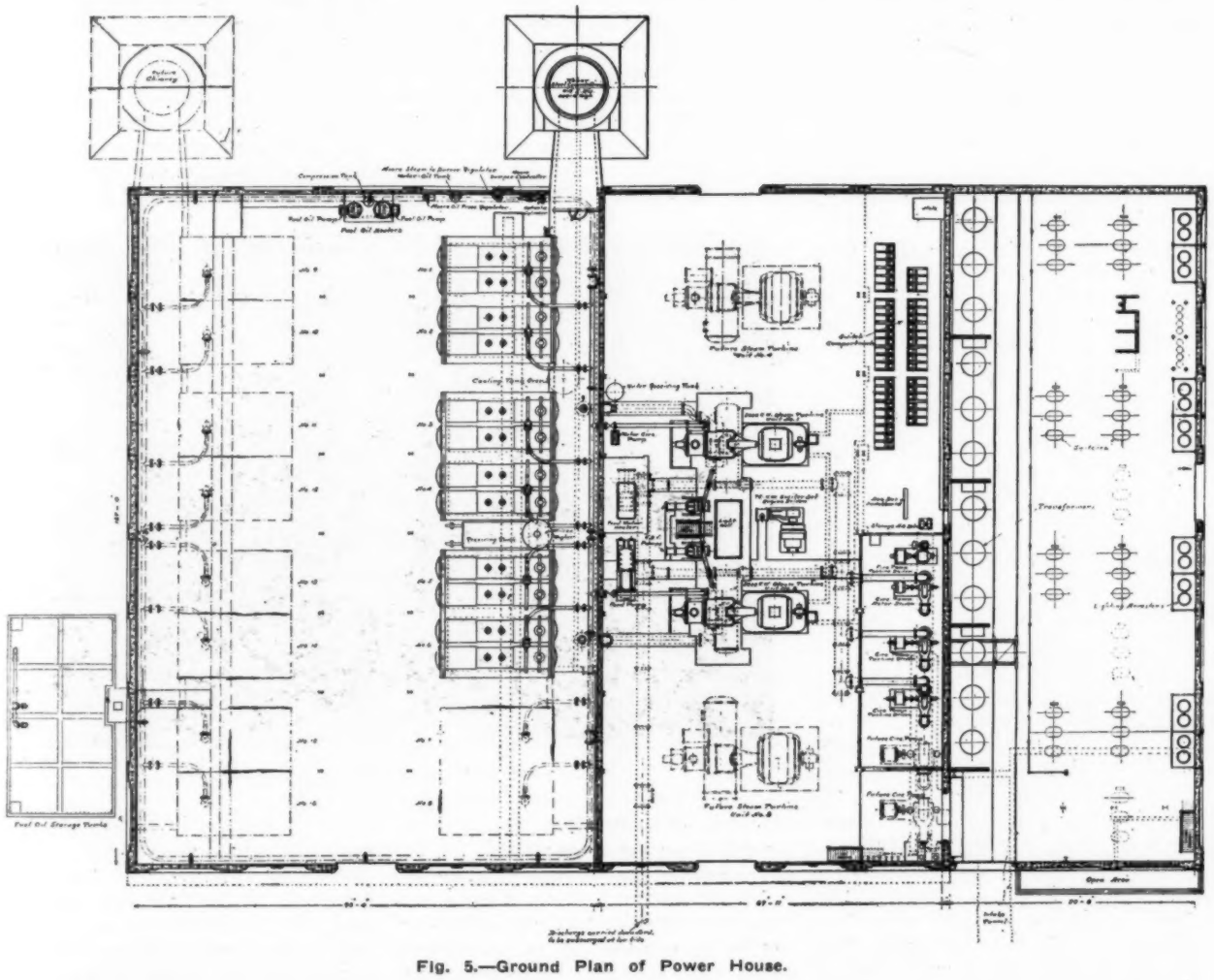


Fig. 5.—Ground Plan of Power House.

periods of time during which the plant may be held in reserve with steam pressure maintained on all piping.

The chimney is constructed of reinforced concrete with a separate concrete lining and air space extending up one-third of its height. It is 255 feet high and 11 feet inside diameter at the top. It is of sufficient capacity to serve eight boilers when operating with coal fuel, and is, therefore, more than able to supply ample draft for the present boiler installation. This chimney is far more pleasing to the sight than the more common type of cylindrical concrete chimney. A brick flue with a concrete cover connects the boilers to the chimney.

For convenience in handling, erecting and repairing machinery, a 30-ton, hand-operated, traveling crane was installed. Also a smaller one for the transformer house has been put in.

Cast-iron circulating water pipes were used throughout. A large water receiving pit was blasted out of the rock directly below the pumps, and this was connected by tunnel with the deep water. Screens of ample area were installed at the mouth of the tunnel. A cast-iron discharge pipe, extending below the surface, provides a water-sealed return which, due to siphon effect, reduces to a minimum the heads against which the pumps have to work.

As the supply of fresh water near the site of the plant was very limited, a supply was obtained from Durant's Lake, four miles away. The company owns the water rights. The level of this lake is about 500 feet above the level of the site of the plant, and at its outlet a timber-crib, earth-filled dam, 12 feet high, with ample spillway capacity, has been constructed. The pipe line, for the distance of two miles from the dam, is a steel pipe 6 inches in diameter, and for the remaining two miles, it is 4 inches in diameter. This water is delivered at the site of the plant into a 50,000-gallon wooden tank, 24 feet in internal diameter, and 16 feet high, and placed at such an elevation on the fill as to give suitable head for general service about the plant.

The generators and motor-generators are connected to the 2,300-volt busbars through a flexible system of switches, so that any piece of apparatus can, if necessary, be isolated from the rest of the plant. These switches are controlled from a black-slate switchboard placed on a gallery in the annex of the turbine room. In the high-tension switch room, necessary switches for controlling the following high-tension lines are provided: one three-phase, 60,000-volt, incoming line in the Jordan River plant; two three-phase, 60,000-volt, outgoing lines to Rock Bay substation, Victoria; one three-phase, 60,000-volt, outgoing line to the Tod Inlet Cement Works and the Bamberton Cement Works. Each of the circuits is protected by means of aluminum-cell lightning arresters.

The necessary switches are also provided for the following feeders: two three-phase, 11,000-volt power feeders; two 600-volt, direct-current interurban railway feeders. All of these switches are controlled from the 16-panel black-slate switchboard, from which the generator switches are operated.

For this purpose, a 60-cell, 300-ampere storage battery is used. This battery will also supply current for emergency lights in the building. For motors, pumps, blowers, etc., used in the building, a 2,300-volt service bus is provided. It is protected from the main bus by an oil switch, of high breaking capacity. The service feeder switches are hand-operated.

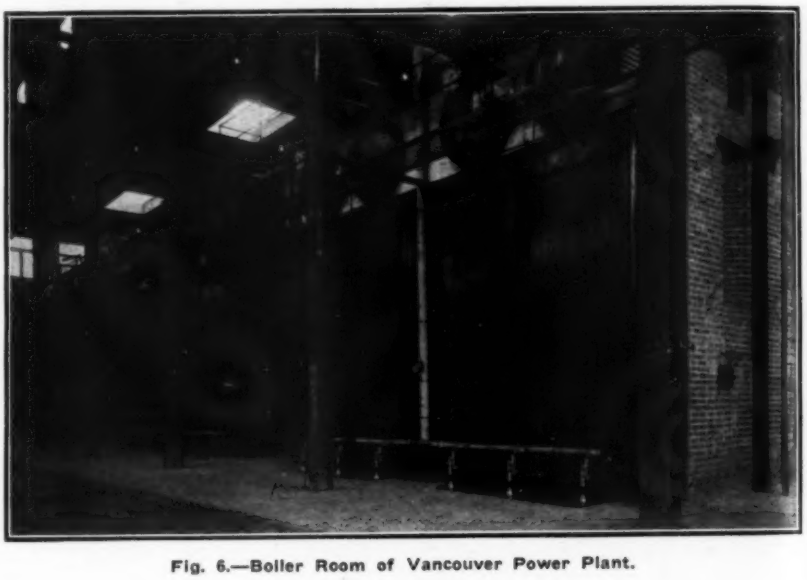


Fig. 6.—Boiler Room of Vancouver Power Plant.

The proposed ultimate development of the Brentwood Bay steam plant is 20,000 kilowatts. The preliminary installation consists of two 2,000-kilowatt Allis-Chalmers turbo-generators, as much better delivery could be obtained on units of this size than on those of 5,000 kilowatts. The 2,000-kilowatt units are so located in the middle of the turbine room that they can be replaced by 5,000-kilowatt units, if this course is found desirable. The location of the 2,000-kilowatt units is also arranged so that if these units are left in place, one 7,500-kilowatt unit can be placed on each side of the existing ones.

As previously stated, the contractors for the work were Charles C. Moore & Company, of San Francisco and Seattle. C. R. Weymouth is chief engineer of the company and had charge of the designing of the plant. J. H. Hopps, advisory engineer, and J. R. Atchison, superintendent of construction, represented the contractors on the ground. The work was under the general direction of G. R. G. Conway, chief engineer of the British Columbia Electric Railway, Limited, assisted by M. V. Hunt, electrical engineer, and G. M. Tripp, engineering superintendent.

Organization of Ohio Power Companies Perfected.

The organization of the several subsidiary companies which will distribute the current of the Floodwood generating plant at Floodwood, O., controlled by the Central Electric Producing Company, has been completed. The four companies operating in the various towns served, and handling the output, are all controlled by the Ohio Electric Securities Company, which was organized under the laws of Maine for that purpose. These four companies, besides the one named, include the Hocking Power Company, operating in and around Nelsonville, O.; the Mutual Electric Company, operating in Middleport and Pomeroy; and the Athens Electric Company, at Athens. The last named company, which recently took over the distributing system of the company formerly operating at Athens, expects to expand its facilities considerably this fall, in order to serve a larger part of the population. Plans are also under way for serving a greater number of mines than the ten at present reached by the company's wires, the present dullness in the Hocking coal fields, however, being an abstacle to this part of the work. P. C. Morris, of Nelsonville, has been made vice-president and general manager of the several properties named.

Program for Panama-Pacific Convention.

The sessions of the Panama-Pacific convention of the American Institute of Electrical Engineers, will be held in the Native Sons of the Golden West Building, San Francisco, Cal., September 16, 17 and 18. Headquarters will be at the St. Francis Hotel. Joint sessions with the American Electrochemical Society and the Institute of Radio Engineers have been arranged.

The following program of papers has been announced, parallel sessions being held on Thursday and Friday.

Thursday, 10:30 a. m.

"Physical Limitations in Direct-Current Commutating Machinery," by B. G. Lamme.

"Automatically Controlled Substations," by E. W. Allen and Edward Taylor.

Marine and Lighting Session.

"Standard Marine Electrical Installations," by H. A. Hornor.

"Recent Improvements in Electric Lighting of Steam Railroad Cars," by R. C. Lanphier.

2:30 p. m.

Three parallel sessions will be held as follows:

Electrophysics Session.

"The Effects of Transient Voltages on Dielectrics," by F. W. Peek, Jr.

"Arc Phenomena," by A. G. Collis.

"Experimental Researches on Skin Effect in Conductors," by A. E. Kennelly, F. A. Laws, and T. H. Pierce.

Valuation of Public Utilities Session.

Symposium on Inventories and Appraisals of Properties.

Part I, by C. L. Cory.

Part II, by W. G. Vincent.

Part III, by W. J. Norton.

These papers will be supplemented at the session by contributions from other members of the Committee on Inventories and Appraisals of Properties.

Joint Session with the Institute of Radio Engineers.

"Sustained High-Frequency High-Voltage Discharges," by Harris J. Ryan and Roland G. Marx.

Friday, September 17, 10:00 a. m.

Two parallel sessions will be held, as follows:

Telephony and Telegraphy Session.

"Submarine-Cable Rapid Telegraphy: Ocean and Intercontinental Telephony," by Bela Gati.

"Automatic Switchboard Telephone System of Los Angeles," by W. Lee Campbell.

"Continuation of Discussion on Inductive Interference." Introduced by Joint Committee on Inductive Interference.

Mine Work Session.

"Diesel Engines for Generator Drive," by Charles Legrand.

"A Large Electric Hoist," by Wilfred Sykes.

"The Modern Electric Mine Locomotive," by Graham Bright.

2:30 p. m.

Three parallel sessions will be held, as follows:

Joint Session with the American Electrochemical Society.

"Overhead Electrolysis and Porcelain Strain Insulators," by S. L. Foster.

"Corrosion of Copper Wireless Antennae," by L. W. Webb.

"Electrochemical Possibilities in California and on the Pacific Coast," by J. W. Beckman.

Transmission Session.

"Delta-Cross Connection of Transformers," by G. P. Roux.

"Harmonics in Transformer Magnetizing Currents," J. F. Peters.

"Phenomena Accompanying Transmission with some Types of Star Transformer Connections," by L. N. Robinson.

"Abnormal Voltages in Transformers," by J. Murray Weed.

"Calculation of Short-Circuit Phenomena of Alternators," by N. S. Diamant.

Joint Session with the Institute of Radio Engineers.

"Radio Development in the United States," by Robert H. Marriott.

The other national engineering societies will be holding meetings at the same time. The American Society of Mechanical Engineers will meet in the same building, but will have headquarters at the Clift Hotel. The American Society of Civil Engineers will meet at the St. Francis Hotel. The American Institute of Mining Engineers will meet at the Bellevue Hotel.

These meetings precede the International Engineering Congress, which will meet during the week September 20 to 25, in the new Civic Auditorium. Over 3,000 members have already been enrolled in the Congress.

The membership fee is $5.00 and should be sent to W. A. Cattell, secretary, Foxcroft Building, San Francisco. Members are entitled to one volume of the printed proceedings free; other volumes can be secured by purchase, there being 11 in all.

Sessions of the Congress devoted to electrical engineering will be held on Thursday morning and afternoon and on Saturday morning. The following papers will be presented:

"Economics of Electric Power Station Design," by H. F. Paishall, London, Eng.

"The Water Power of Sweden," by Sven Luebeck, Stockholm, Sweden.

"Electric Power in Canadian Industry," by Charles H. Mitchell, Toronto, Can.

"Industrial Effect of Low Cost of Electric Energy," by Louis A. Ferguson, Chicago, Ill.

"The Effect of Hydroelectric Power Transmission upon Economic and Social Conditions, with Special Reference to the United States," by Frank G. Baum, San Francisco, Cal.

"Electrical and Mechanical Installations of the Panama Canal," by Edward Schildhauer, New York, N. Y.

"Electric Welding," by C. B. Auel, Pittsburgh, Pa.

"The Application of Electricity to the Heating of Metals," by F. L. Bishop, Pittsburgh, Pa.

"The Electric Motor as an Economic Factor in Industrial Life," by David B. Rushmore.

"The Influence of the Electric Motor on Machine Tools," by A. L. De Leeuw, Elizabethport, N. J.

"Effects of Electrolysis on Engineering Structures," by Albert F. Ganz, Hoboken, N. J.

"The Mechanical Problem of the Electric Locomotive," by G. M. Eaton, East Pittsburgh, Pa.

"On the Production of High Permeability in Iron," by Ernest Wilson, London, Eng.

"Electric Illumination," by S. H. Blake, Schenectady, N. Y.

Lighting Installation Guards Factory from Intruders.

An effective means of lighting a factory grounds, to prevent improper entrance, is installed at the works of the Merrimac Chemical Company, North Waburn, Mass. This concern is manufacturing high explosives for the European armies, and in order to make certain provision against spies or other improper visitors by night, the company has erected a 10-foot wire-net fence completely around a 15-acre lot containing five mills. About 25 feet inside the fence is a line of poles, about 30 feet apart, each carrying a 16-watt Mazda lamp with metal reflector, on an arm directed toward the fence.

This lighting installation gives a view of the space between the fence and the buildings, so that the watchmen, of whom there are several on guard constantly, will detect any person entering the grounds.

A newspaper story that wires for high-tension current were installed in connection with the fence was characterized by Superintendent Shannon as false, there being no intention to utilize this method of protection, he said.

The electrification of industries in India by expert Americans and with American machinery is brought out in the new 640-page India Hand Book, price $1, which is obtainable from the Superintendent of Documents, Washington, D. C., or from the eight branch offices of the Bureau of Foreign and Domestic Commerce in Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco.

Program of Electrochemical Society.

The following papers have been announced for the twenty-eighth general meeting of the American Electrochemical Society, which will be held at San Francisco, Cal., September 16-18, with headquarters at the Clift Hotel:

"The Cottrell Process on Silver Furnace Gases," by Charles H. Aldrich.

"Collection and Therapeutic Use of Radium Emanation," by R. S. Bosworth.

"Electrolytic Precipitation of Gold, Silver and Copper from Cyanide Solutions," by G. H. Clevenger.

"Solution Stratification as an Aid to the Purification of Electrolytes," by F. Pyne.

"Electrolysis of Copper-Sulphate Liquors Using Carbon Anodes," by Lawrence Addicks.

"Use of the Flaming Arc in Paint and Dye Testing," by W. R. Mott.

"Radiography of Metals," by W. P. Davey.

"Electrolytic Antimony Refining," by Anson G. Betts.

"Electrodeposition of Nickel," by C. W. Bennett, C. C. Rose and L. G. Tinkler.

"Power for Electrochemical Industries," by D. R. Lyon and R. M. Keeney.

"Peptonization of Chromium Oxide," by W. D. Bancroft.

"Synthesis of Phenylhydroxylamine," by F. M. Frederiksen.

"Electric Steel Costs," by F. T. Snyder.

"Electric Furnace Melting of Ferroalloys," by R. S. Wile.

"Heat Losses from an Electric Steel Furnace," by W. H. Wills, Jr., and A. H. Schuyler.

"Electrochemical Possibilities on the Pacific Coast," by J. W. Beckman.

"Electromotive Forces," by W. D. Bancroft.

Graphite.

The United States is a large consumer of the several kinds of graphite, but only a moderate producer, much of the graphite used in this country being imported from Ceylon and Mexico. Relatively large quantities of amorphous graphite are, however, manufactured at Niagara Falls.

The graphite industry in 1914 was somewhat affected by the war, which after October practically stopped the importation of graphite from Ceylon and Madagascar into the United States until the close of the year. The larger American dealers had a reserve stock on hand, so there was no serious shortage during November and December, and since then trade has so adjusted itself that Ceylon graphite now comes into this country by way of London. In spite of the disturbed conditions in Mexico, the imports of graphite from that country nearly equaled those for 1913.

According to Edson S. Bastin, of the United States Geological Survey, the production of natural graphite in 1914 in the United States amounted to 4,336 short tons, valued at $324,118. Of this quantity, 1,725 tons were amorphous, valued at $38,750, and 2,611 tons were crystalline, valued at $285,368. The greater part of the crystalline graphite—all the "flake" variety—was produced in New York, Pennsylvania, and Alabama. A small quantity of crystalline graphite was produced in Montana. The entire output of natural graphite in 1914 showed an increase in value as compared with that of 1913 but a slight decrease in quantity.

The production of manufactured graphite in 1914 by the International Acheson Graphite Company, of Niagara Falls, was 10,455,139 pounds, or 5,228 short tons, valued at $698,800. This is an average price of $6.68 per ton.

Wasteful Coke Production.

While Germany is carefully conserving her resources by coking her fuel output in by-product ovens to save the valuable tar, ammonia, gas, and benzol, the United States is literally throwing away these useful products to the value of millions of dollars annually by the continued use of the wasteful beehive oven.

In 1914 the total output of coke in the United States was 34,555,914 short tons, valued at $88,334,217. Of this 23,335,971 tons was made in beehive ovens, with an almost total loss of the by-products, and 11,219,943 short tons was produced in by-product ovens, with a recovery of over $17,500,000 worth of by-products, or approximately $1.55 for each ton of coke. As there were over 23,000,000 tons of beehive coke made in 1914, and as the yield of coal in coke is less in beehive ovens than in by-product ovens, the loss of by-products from coal made into coke in the beehive ovens in 1914 was not less than $40,000,000.

Program of Convention of Southeastern Section, National Electric Light Association.

For the annual convention of the Southeastern Section of the National Electric Light Association, to be held at Asheville, N. C., September 22 to 24, the following program of papers has been announced: "Accounting," by A. A. Wilbur, Columbus, Ga.; "Advertising and Its Direct Relation to the Central-Station Field," by J. J. McManus, Harrison, N. J.; "Electric Heating Devices," by W. H. Stearns, Pittsfield, Mass.; "Distant-Control Switchboard Design," by T. W. Fuller, Atlanta, Ga.; "Electric Power for Driving Textile Mills," by H. A. Orr, Anderson, S. C.; "Efficiency in Serving the Consumer," by J. H. Mohl, Cordele, Ga.; "The Sale of Energy to Municipally Owned Systems of Street Lighting," by W. Rawson Collier, Atlanta, Ga., and "High-Tension Systems and Their Operation," by W. E. Mitchell, Birmingham, Ala.

At the close of the first day's sessions a barbecue will be tendered the delegates by the Asheville Board of Trade. On Thursday evening a public-policy session will be held, the feature of which is expected to be an address by the Governor of the State. Entertainment and dancing will follow.

Novel Plan for Changing Transformer Oil.

At the Toppenish, Wash., substation of the Pacific Power & Light Company it became necessary to change the oil from three 200-kilovolt-ampere transformers to another bank of 333-kilovolt-ampere rating, just installed. As this work could not be done with transformers in use and eliminated the possibility of employing electric power, a simple and rather ingenious method was devised for executing the work by means of an automobile. One of the rear wheels of the car was jacked up, a three-inch belt run around the tire and over a pulley on the end of the motor shaft governing the oil regulation. With automobile engine running, the control of speed was readily obtained from the gas throttle. The result attests to the effectiveness of the idea: the oil was transferred in record time at a considerable saving of labor.

Swedish Water Powers.

The annual Year Book of the Swedish Chamber of Commerce in London contains an article on the subject of the utilization of water power in Sweden. Among the important power stations in Sweden are the following:

	Horsepower
South Swedish Water Power Company	27,000
Hemsjo Water Power Company	10,280
Yngeredsfors Water Power Company	16,250
Trollhattan (to be extended to 100,000-120,000 horsepower)	80,000
Gullspang-Munkfors Water Power Company	16,950
Guldsmedshytte Company	6,750
Virsbo-Ramnas Water Power Company	3,045
Untra Water Power Works (still under construction)	42,000
Alfkarleby Water Power Works (to be completed during the present year)	45,000
Horndals Ironworks Company	8,000
West Dal River Water Power Company	19,200
Graningeverkens Company	9,150
Klabbole	4,525
Finnforsen	9,400
Sikfors	5,000
Porjus	50,000

In addition to these there are numbers of water powers utilized for private industrial plants. Five of the largest of these aggregate 130,000 horsepower.

Government Exhibits at New York Electrical Show.

At the forthcoming New York Electrical Exposition the United States government will be represented on a larger scale than ever before, according to plans now being made. The War Department will demonstrate the manufacturing of rifles and sabers and the signal corps of the army will exhibit and operate a comprehensive wireless plant. The United States Navy will prepare a five-kilowatt wireless sending and receiving station, and the central generating station of a dreadnaught. The work on these exhibits is being done at the New York Navy Yard. The systems of communication and control of a modern battleship will also be shown, including telephones, fire alarms, light and bell signals, etc.

A complete "money-washing" plant will be installed and operated by the Treasury Department.

New York Municipal Telephone Service to be Investigated.

A special committee has been appointed by the mayor and controller of New York City, to investigate the telephone service to the municipality. The committee is composed of Putnam A. Bates, electrical engineer of the Fire Department and chief engineer of the Bureau of Fire Alarm Telegraph, chairman; Michael R. Brennan, superintendent of telegraph of the Police Department; Robert B. McIntyre, supervising statistician and investigator, and Chester M. Gould, assistant engineer of the Department of Finance.

It is intended to analyze the nature and different classes of service rendered by the telephone company, and to investigate such technical points as routing of leased wires, duct space allowed in subways, mechanical devices applied, and also practical questions bearing on the departmental use of the city's telephones.

Exploitation of Finland's Waterfalls.

The Petrograd Joint Stock Company for Transmission of Water Power has made application to the Governor of Vyborg for permission to exploit the water power from the waterfalls of Rouhialasky. It is proposed to build a dam reaching from one bank to the other, with five passages of 46 feet in width for the water currents, of a depth of 58 feet. According to the calculations of the Finland Hydrographic Bureau, the flow of water is 42,000 cubic feet per second, and can be directed through four passages. The project provides for the erection of nine aggregates of turbines of 10,000 horsepower each.

BOOK REVIEWS.

"Electricity in Coal Mining." By David R. Shearer. New York: McGraw Hill Book Company, Incorporated. Cloth, 84 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $1.50.

This is a brief and rather superficial volume which touches some of the high spots connected with the consideration of the use of electricity in coal mining. The author states in the preface that it is intended for the use of investors and operators in outlining methods of procedure, and also for the operating engineer. The latter, it is to be feared, would not get much out of such a book, but for the former there are numbers of valuable suggestions. Illustrations are given of a number of types of modern machinery, and especially of motor drive and the storage-battery locomotive. The book is divided into 13 chapters, to each of which but a few pages is devoted. The typography is good and the large type makes reading very comfortable.

"The School of Practical Electricity, Vol. I." By Oscar Werwath, assisted by George J. Kirchgasser, F. C. Raeth and W. E. Hennig. Milwaukee: Electroforce Publishing Company. Cloth, 410 pages (6½x10 inches), illustrated. Supplied by Electrical Review Publishing Company, Inc. for $4.50.

This volume has been prepared for the student and is intended to be used either for home study or to accompany the lectures given in the School of Engineering with which the authors are associated. It also contains suggestions for laboratory problems and experiments. The treatment of the subject is simple and it should prove to be readable and easily understood by the average student, being especially suited to those who have not had elaborate preparatory work. A large number of problems are given which will help the student to test his knowledge of the subject by applying the information which he has absorbed. The illustrations are profuse and are in general well selected. The volume is divided into five sections, which treat separately of the following subjects: First Principles of Electricity; Theory of Direct Current; Electric Light Wiring; Magnetism and the Commercial Application of Magnets; Telephony.

The section on electric light wiring seems to be especially well written and is quite practical. It contains much information seldom found in textbooks and is illustrated with fittings and materials in every-day use. The last chapter in this section, however, which deals with the wiring of a residence, is rather brief and perhaps assumes too much information on the part of the student. The reviewer considers it very objectionable to use the symbol *C* for current, when the letter *I* has been adopted for this purpose not only by the American Institute of Electrical Engineers, but also internationally, and this is especially true in a volume intended for students, who should be familiarized first of all with standard practice. Alternating currents are not considered in this volume and there is no reference to motors or other machinery and apparatus, which it is stated will be considered in a second volume. Taken altogether this book should prove very helpful to the student of the subjects which come within its scope. An error in a formula on p. 116 has been corrected in the reviewer's copy and presumably in others also.

Municipal and Government Electric Railways in Ontario.

The formal opening of the London & Port Stanley Railway took place at London, Ontario, on July 22, in the presence of a score of members of the Canadian Parliament, a dozen mayors of cities, including Toronto, Hamilton, Stratford, St. Thomas and Windsor, and some 800 representatives of the various municipalities that are now using hydroelectric power. This road, which extends from London to Port Stanley on Lake Erie, a distance of 25 miles, is the first radial (or interurban) railway built under the supervision and control of the Ontario Hydroelectric Commission. The new road had for three weeks before its formal opening been carrying freight and passengers, the latter to the number of about 40,000 in that time.

As to the ability of the municipalities to handle radial railway lines successfully, Sir Adam Beck, chairman of the Hydroelectric Commission, made a statement to show that the financial position of the hydroelectric system was so good that the Commission has already this year a surplus of $50,000 to the credit of the 70 municipalities using its hydroelectric power, and that, too, after paying not only all the original expenses but sinking-fund payments as well, although it was not intended that the municipalities should be called upon for sinking-fund payments for a number of years.

As estimates have been prepared on the cost of constructing nearly 1,500 miles of roadbed for electric railways, and as several municipalities have voted in favor of building rural car lines, it is expected that there will be a rapid extension of the use of hydroelectric power when financial conditions become favorable to investments in new undertakings. As car lines are built it will be possible to extend the use of such power for agricultural and domestic purposes.

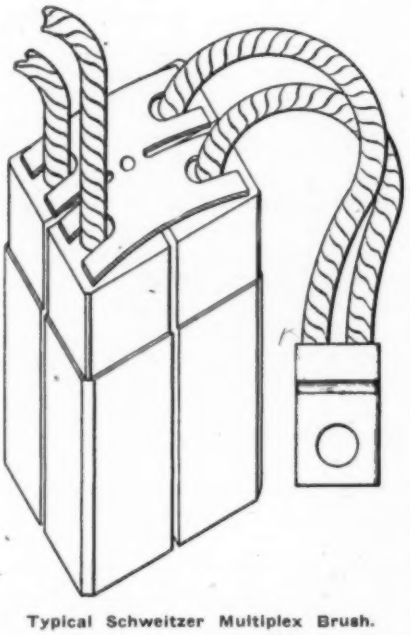
New Electrical and Mechanical Appliances

Schweitzer Multiplex Brush for Commutators and Collector Rings.

Commutation is such an old problem and one that has been discussed so fully and so often that for anything new pertaining to commutation to be justified in appearing at this time it must differ radically from what has existed previously, and accomplish what has not been accomplished before. The Schweitzer multiplex brush recently placed on the market by the Chemelectrical Company, 4327 Kenmore Avenue, Chicago, Ill., appears to fulfill both of these conditions. It is unquestionably ingenious and original, yet very simple. If it accomplishes what is claimed for it, its appearance is fully justified and will be welcomed by operating engineers.

In the endeavor to obtain the greatest output per unit of weight of material and the lowest possible losses, it has been necessary to resort to higher peripheral speeds, increased voltages between bars, and low-resistance brushes employing high current densities. As a result, the problem of picking up the current has changed from a simple one requiring only attention to a few mechanical details to a very serious and absorbing one. It is in this regard that the Schweitzer brush claims to meet the demands as no other brush on the market is able to do.

The Schweitzer multiplex brush consists simply of a brush subdivided into a number of sections (the accompanying illustrations show a four-section brush), each section being so arranged as to permit of movement radially away from the rotating element without affecting in any way the close contact of the remaining sections, except in so far as to increase their tension to a value such that the total pressure remains the same at all times. Between the various sections is placed a spacer or barrier of soft metal or of carbon, as the case may be, having a high specific resistance. The function of this spacer is to reduce the short-circuit current in the coil undergoing commutation and practically eliminate the circulating current in the brush by interposing a high transverse resistance radially through the brush. This barrier, besides assisting the commutation, enables a higher efficiency through the brush, since the circulating current is so largely reduced, which is in striking contrast to the great loss in efficiency accruing from the use of high-resistance brushes previously employed for this purpose because the internal resistance must be exorbitantly high to be comparable with the desired transitional resistance. While the brush has been designed, primarily, to enable intimate contact between commutator and brush to be maintained at all times and under all conditions, it is seen that it also acts as a decided aid to commute the current by reducing sparking, and extending the limi-

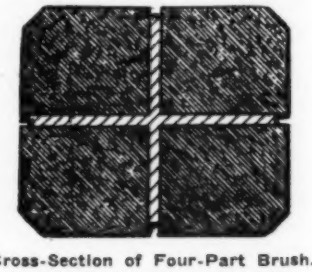


Typical Schweitzer Multiplex Brush.

tations imposed by commutation while permitting higher current densities in the brush for a given temperature rise.

Although accomplishing several functions at one and the same time, the brush is neither bulky nor complicated. The springs are integral one with another and the whole brush and holder is simple, rugged and strong. There is nothing that can become deranged more than is the case with the ordinary brush, and the manufacturer claims that considerably less attention is required of commutator and brushes where this brush is used, since the lower brush tension employed causes less dust and dirt to accumulate, less sparking and wear and tear generally. The better contact at all times reduces, even under the worst conditions, sparking, blackening, pitting and flat spots; frequently the overloading capacity of a machine may be increased, and flashing-over averted; the life of commutators is lengthened and the cost of brush renewals decreased; there is also a lower cost of labor.

The brush finds application for all conditions of collecting current and commutation. In some instances its need is vital, whereas in others it is simply beneficial. The Chemelectrical Company specially recommends this brush in all cases where commutation is unfavorable and unsatisfactory, as where dirt and foreign matter are encountered, for example, around coal docks, steel mills, etc.; for large-capacity rotary converters; for direct-current turbogenerators, where the peripheral speeds are usually two or three

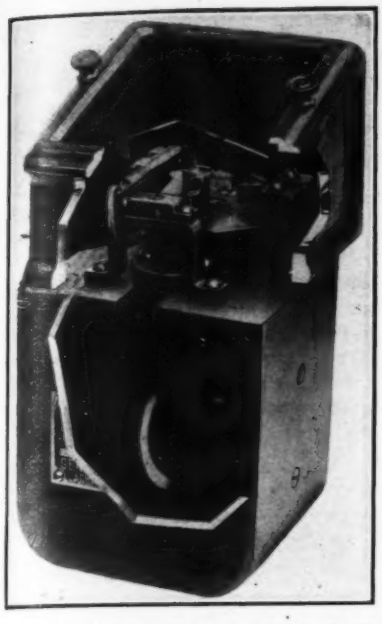


Cross-Section of Four-Part Brush.

times normal; and for railway service, where the conditions are extremely unfavorable to commutation and inspection is infrequent. Where reliability and immunity from commutator trouble is of paramount importance, inspection irregular and expensive, this brush will be found a good investment is the claim of the manufacturer. From its use it is stated that commutators will have longer life, fewer grounds will develop, and the cost of brush renewals, together with the labor cost of renewing them (a large item in railway service) will be reduced.

Relays for Protection of Single Alternating-Current Tie Lines.

Single-pole, double-throw relays of the type illustrated have recently been developed by the General Electric Company. These relays provide a simple and effective means of isolating trouble automatically on a single tie line joining parts of an alternating-cur-

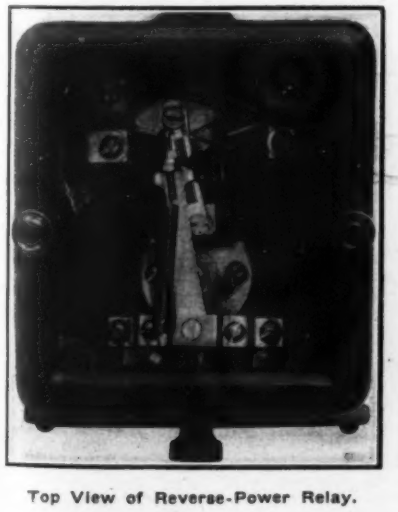


View Showing Interior of Reverse-Power Relay.

rent system. Two relays connected together by pilot wires are required on each end of a three-phase tie.

Under normal conditions, irrespective of the direction of the power, which may reverse at any time over the entire tie line, depending on the distribution of the load and the characteristics of the system, the relays have no effect on the oil switches. If, however, a short-circuit occurs in the tie line while power is being fed from one part of the system to the other, this power will go directly into the short, while the power in the tie between the short and the part of the system previously receiving power will reverse and also feed into the short. This will operate the contacts of the relay in the reversed portion of the line, which will cause the oil switches on both ends of the line to trip and isolate the line from the rest of the system.

The relays will not operate on overload, or on trouble on other lines unless accompanied by a reversal of power only on one end of the line which they are meant to protect. They will, however, operate on very little reverse power, even at low voltage and low power-factor, and are consequently of great value for the service recommended.



Top View of Reverse-Power Relay.

New Motor-Generator Set for Charging Automobile Batteries.

The Robbins & Myers Company, Springfield, O., has recently developed the motor-generator set shown herewith, for charging batteries for automobiles, motor boats, etc.

They may be operated from 110 and 220-volt direct-current circuits or 115 and 230-volt, 60-cycle alternating-current circuits.

Three sizes are made—80, 150 and 250 watts. The 80-watt size is suitable for private garage service, but it is sometimes used in public garages when the service is light and not more than one battery has to be charged at a time. The 150 and 250-watt sizes are for public-garage service.

Small Battery-Charging Motor-Generator Set.

The 80 and 150-watt outfits are light in weight and can easily be moved about; they are fitted with an oak base so they can be placed on the running board of a car without marring the finish. The 250-watt size is usually installed in a permanent position in the garage.

The 80-watt, 8-volt outfits will charge one three-cell, six-volt battery at a time, starting at a 10-ampere rate.

The 150-watt, 15-volt outfits will charge at the same time, either one 12-volt, or one six-volt, or two six-volt batteries in series, starting at a 10-ampere rate.

The 150-watt, 30-volt outfit and the 250-watt, 30-volt outfit will charge at the same time, either four six-volt batteries in series, or two 12-volt batteries in series, or one 12-volt and two 6-volt batteries in series, or one 24-volt battery, the 150-watt set starting at a five-ampere rate and the 250-watt set starting at a 10-ampere rate.

Eighty and 150-watt sets are regularly furnished with 10 feet of duplex cord and detachable plug on the motor side and with 10 feet of heavy duplex cable with universal lead-covered test clips on the generator side. These leads are substantially anchored to the frame of the machine.

The 250-watt sets have leads brought out of the frame through bushed holds. The ends of these leads are fitted with brass connectors. Four leads are brought out of the generator sides, two being the line leads and the other two intended for connection to the field rheostat.

The 80 and 150-watt outfits are equipped with wick oilers for lubrication. The 250-watt outfits have ring oilers.

To use, a plug on the motor cord is screwed into a lamp socket and the switch is turned. After the set has attained full speed, the generator terminals are connected. As the generators are shunt-wound, either clip can be connected to either terminal of the battery and the generator polarity will adjust itself automatically to the polarity of the battery. After the battery becomes fully charged the generator may be left floating on the battery without injury.

The 80 and 150-watt sets are designed so as to automatically give a tapering charge to the battery, and no rheostat is needed in the generator field.

The 250-watt sets are furnished with a rheostat in the generator field for adjusting the rate of charge.

The motors of all of these outfits will operate without injury on voltages 10 per cent higher or lower than normal. The motors can be thrown directly across the line; no starting rheostat is required.

Flush Receptacle.

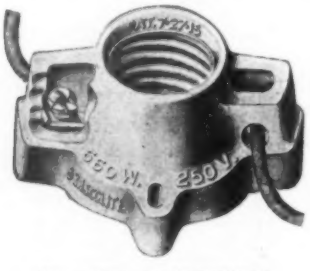
Screw-Plug Flush Receptacle.

The accompanying illustration shows the new C-H No. 7642 screw plug receptacle with flush plate, which has been added to the specialties line of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This receptacle, which can be placed in wall

or baseboard, provides a better means for connecting a table lamp, fan, or heating appliance than does a chandelier or wall bracket. A spring contact in the receptacle insures good contact, even in places where there is jarring or vibration. Flush plate No. 7643 has a hinged lid which can be closed when the receptacle is not in use. No. 7644 plate is without lid. The approval of Underwriters' Laboratories has been obtained for this new receptacle and the rating given is 660 watts, 250 volts.

New Receptacles for Semi-Indirect and Similar Fixtures.

The two receptacles illustrated herewith are now being furnished as regular



New Fixture Receptacle.

equipment with Brascolites as manufactured by the Luminous Unit Company, St. Louis, Mo. They present a quite radical departure from present practice in that the use of pigtails is eliminated and thus the expense consequent to the making of a soldered and taped joint is also avoided.

The contact terminals are of the regu-

Two-Part Receptacle.

lar screw type but are inclosed or protected by porcelain which is a part of the receptacle body. An aperture is provided for the insertion of the wire and also for a screw-driver to operate the terminal screws. These receptacles are made in both medium and mogul sizes.

While these receptacles were first designed and exclusively used in the company's Brascolite semi-indirect unit, it is now the intention of the Luminous Unit Company to place them on the market for use in all types of fixtures and for such service as they may be particularly adapted to by reason of their improved construction.

Two-Bulb Headlight, 15 and 4 Candlepower.

Tail Light, 2 Candlepower.

Westinghouse Electric Equipment for Ford Cars.

The latest addition to the list of Ford accessories is the Westinghouse starting and lighting system, with optional addition of ignition.

The starting and lighting system consists of a single unit that acts both as starting motor and lighting generator, in connection with a storage

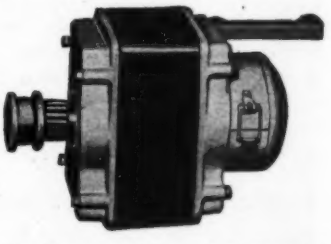
Ignition Unit and Bracket.

battery furnished as part of the equipment.

When the starting switch is closed the electric unit acts as a motor, drawing current from the storage battery, driving the engine at a speed of about 175 revolutions per minute. The engine picks up and drives the unit as a generator when the car reaches nine miles per hour on high gear, furnishing current for the lights and for charging the storage battery.

The single-wire (ground return) arrangement of wiring is used in the Ford equipment, all necessary wire and connections being furnished. Throughout there is only one wire instead of two, the frame of the car being used as the return circuit. The simpler system, it is claimed, gives greater clearance for insulation, ample size of contact parts, about half the number of connections and lower voltage loss, and reduces the liability of trouble due to short circuits, etc.

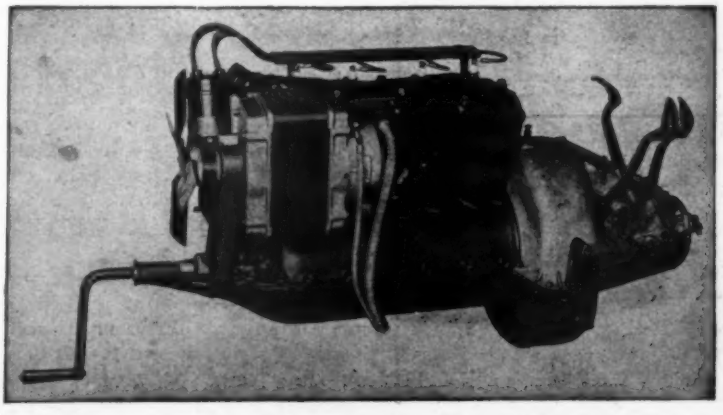
An inclosed Morse silent chain drives the electric unit positively from a special shock-absorbing pinion on the crankshaft. This comparatively low speed assures a long life for the bearings, brushes and commutator. The



Westinghouse Electric Unit Complete.

bearings are high-grade imported ball bearings, and the drive bearing is exceptionally large. The spockets are of high-grade steel, oil tempered.

The current supplied is regulated inherently by the windings of the electric unit, and does not depend on complicated controllers. The output of the generator is such as to keep the battery charged under normal operating conditions. At high speeds the charging current tapers off so that the bat-

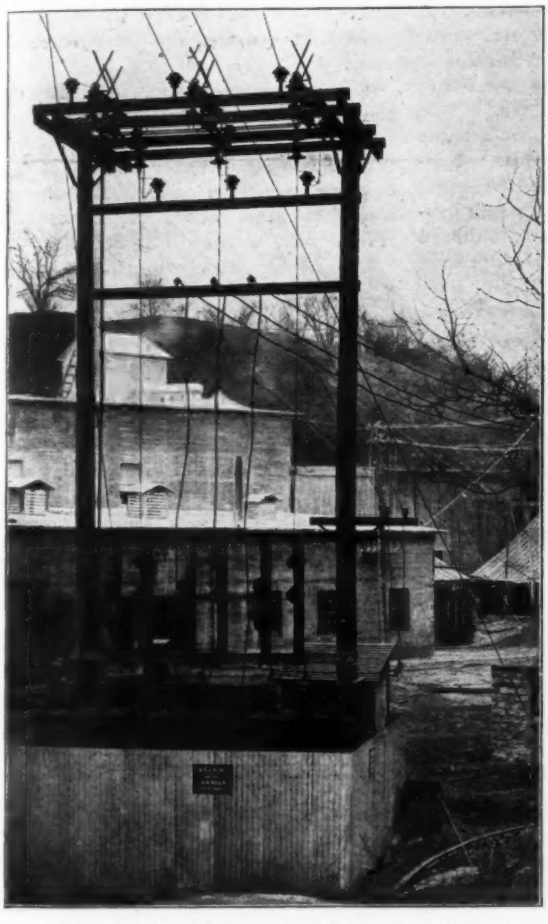


Westinghouse Starting, Lighting and Ignition Set Installed on Ford Engine.

tery does not overcharge when touring. There is nothing to adjust. The slight charging at full charge "gasses" the battery to prevent sulphation of the plates, as recommended by battery makers.

To prevent the electric unit from acting as a motor at low speeds, causing the battery to discharge wastefully, an automatic cutout disconnects the electric unit from the battery whenever the engine speed falls below the generating point.

No normal amount of heat, water, gasoline, or oil can damage the electrical apparatus. A special impregnation treatment of the windings renders them safe from these distinctive factors, and makes it impossible for vibration to shake them loose. A continuous temperature of 250 degrees Fahrenheit will not damage the windings.



Industrial Type 33,000-Volt Outdoor Substation.

The same care is used in designing and manufacturing the parts used in the Westingtouse equipments for Ford cars as in those designed for the highest-priced automobiles.

The Westinghouse vertical ignition unti contains interrupter (timer), ignition coil and condenser, and distributer, all in one unit. Current is derived from the battery.

A positive-acting circuit-breaker with platinum contacts, in the primary circuit, insures a spark in the cylinder at every power stroke, and at the same relative time in every cylinder. The perfect balance of the ignition coil and condenser reduces the sparking at the circuit-breaker contacts to a point where it does not injure the contacts, but gives a fat, hot spark at the spark-plug points.

Like the electric unit, the ignition coil and condenser are given an impregnation treatment that renders them heatproof and waterproof. They are inclosed in a tube of Westinghouse Bakelized Micarta, which protects them from oil and gasoline. The core of the coil is of special silicon-steel to increase the efficiency of the system and produce the hottest possible spark in the cylinder with the lowest possible lag in the coil.

To direct the spark to the proper cylinder is the sole function of the distributer in the Westinghouse ignition unit, the interrupter doing the timing. A flat-surface distributer is used which is easy to inspect and clean.

The Westinghouse equipment includes everything that a Ford owner needs for a complete electrical outfit. Every part of the equipment is fully guaranteed by the Westinghouse Electric and Manufacturing Company.

These equipments are shipped in such a way as to avoid repacking when only part of the full set is sold by the local distributing agent.

Low-Cost 33,000-Volt Substation.

A low-cost industrial type of wooden pole outdoor substation is shown herewith. The high-tension three-phase air-break switch is mounted on two poles, the choke coils and carbon-tetrachloride fuses being mounted just about the transformers, which are at ground level.

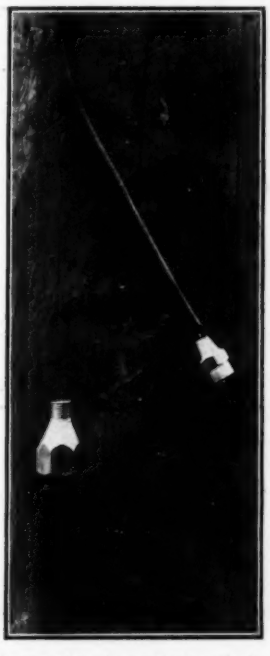
The control switch is operated by means of a square vertical steel shaft, at the lower end of which is a locking type handle. This operating mechanism is permanently grounded, thus eliminating danger to the operator from static shocks.

The high-tension switch, choke coil and fusing equipment is of the standard form manufactured by the Delta-Star Electric Company, Chicago, Ill.

Fargo Ground Connection.

The need for maintaining perfect ground connection on many circuits is calling for a reliable means of joining the ground wire to the ground or earth contact device. Frequently it is desirable to be able to test the ground wire and grounding device separately. Both these features are possessed by the new ground connection made by the Fargo Manufacturing Company, Poughkeepsie, N. Y. The accompanying illustrations show this connection closed for service and open for test.

Ground Connection.



Connection Opened for Test.

The joint between the ground wire and connecting device is on the conical compression principle, similar to that used in the Fargo type A ground point described in our issue of August 7, 1915. This compression joint is said to have several times the conductivity of the wire and the compression is so powerful as to form practically a cold weld, thus insuring the lowest possible re-

sistance. These connections are made for several different sizes of ground wires and ground pipes. The type A connection shown is particularly desirable where periodic testing of the ground connection is necessary. A modified form, known as the type B, employs the twisted double-wire compression principle. Both types eliminate the use of bolts and nuts.

Welding Defective Cores in Paper Mill.

The St. Croix Paper Company, Woodland, Me., was formerly throwing on the scrap pile all broken and defective paper cores or pipes used in the center of large rolls of paper. Much of this material was sold as junk at the best prevailing market prices. Many carloads of broken and defective cores had been disposed of in this manner before it was discovered that all of them could have been made as good as new by employing oxy-acetylene welding.

By using the Prest-O-Lite process of oxy-acetylene welding, broken cores are now repaired in nine minutes. No filling material is used as a method has been found for handling the welding operation so that sufficient strength can be obtained with the material flowed into the weld from the pipe itself. Occasionally, however, a small quantity of filler rod has to be added to insure a joint that will be as strong as the rest of the core itself. The two sections of pipe are prepared by simply cutting off in a machine with the regular cutting-off tool. The ends of the pipe are not beveled, as the extra metal is needed where filling rod is not added.

The cores are steel tubes three inches in diameter and average about fifty inches in length. During the welding operation, they are slipped over an iron arbor of the same diameter as the shaft on which the roll is designed to run, to insure perfect alinement with the longitudinal center.

As these cores accumulate very rapidly in the enormous production of the St. Croix Paper Company it is stated that enough material, heretofore scrapped, is now on hand to furnish several years' supply of new cores without making it necessary to draw on any new material at all.

Tests of welded paper cores indicate that the reclamation process does not affect the original strength in the least; the welded portions withstand rough handling during continual shipping, although frequently the original metal in the tube is broken.

Former methods at repairing these damaged cores were very unsatisfactory.

United States Light and Heating Company in Good Shape.

The stockholders of the old United States Light and Heating Company have received a final circular from the protective committee explaining the formation of the new United States Light and Heat Corporation and its acquisition of the old company's properties.

The new company has a $1,000,000 bond issue, of which $500,000 has been issued, $3,000,000 non-cumulative seven per cent preferred, which is to be held in a voting trust, and $4,000,000 common stock. Par value of both issues is $10. All debts of the old company have been paid with the exception of a few which are being contested.

More than 90,000 shares of stock were deposited with the committee by about 1,800 stockholders. Of this stock less than 100 shares of preferred and 2,500 shares of common stock failed to pay the assessment provided in the reorganization.

The new company is now operating the plant and several new contracts have been secured. In addition to this it is stated that in the near future the closing of two or three very large contracts, which will insure a heavy volume of business for several years to come, may be affected.

"It may be stated," the circular reads, "that should the new contracts discussed be secured, it is the belief of your operating staff that the actual net profits flowing therefrom, joined to your other business, would seem to make probable not only an early payment of dividends on the new preferred stock voting trust certificates, but discussion of applicable surplus earnings on the new common."

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

RECEPTACLES, Standard. — The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, porcelain-shell receptacles.

Keyless, 660 watts, 250 volts.

Wall, cleat and concealed, catalog Nos. 50744, 61039.

Conduit box, catalog No. 9514.

For temporary decorative festoon work, catalog No. 4038.

Keyless, 1,500 watts, 600 volts, catalog No. 5012.

Listed July 22, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins metal-shell, closed or slotted bases.

Pull, 250 watts, 250 volts. For use with metal molding, catalog Nos. Mldg. 486, Mldg. 487, Mldg. 587.

Listed July 30, 1915.

RECEPTACLES, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

P. & S. porcelain-shell receptacles.

Keyless, 1,500 watts, 600 volts, catalog No. 527, with special metal inclosing body and attached eight-inch shade holder.

When used with gas-filled incandescent lamps, this device must not be used in show windows or in other locations where flammable material is liable to come in contact with lamp equipment, and must, if within buildings, be connected to the circuit with conductors of standard slow-burning or asbestos covering.

Listed July 30, 1915.

SOCKETS, Standard.—The Connecticut Electric Manufacturing Company, Bridgeport, Conn.

C. E. M., 660 watts, 250 volts.

Key, catalog No. 11051. Keyless, catalog Nos. 11061, 11062, 11063.

Zee, 660 watts, 250 volts.

Key, catalog Nos. 351, 352, 353. Keyless, catalog Nos. 360-363 inclusive.

Listed July 26, 1915.

SWITCHES, Surface Snap.—The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins. (With metal covers.)

Four-way, 1 ampere, 250 volts, 10 amperes, 125 volts, catalog No. 2616.

Listed July 17, 1915.

THEATER APPLIANCES.—American Lighting Company, 747 Railway Exchange Building, Chicago, Ill.

Special fixture for use as a flood or spot-light, consisting of an adjustably mounted drum inclosing reflector and 1,000-watt gas-filled incandescent lamp. Provided with glass front or removable, non-flammable, gelatine slides.

Listed July 26, 1915.

Current Electrical News

ATLANTIC STATES.

MANCHESTER, N. H.—The Manchester Traction, Light and Power Company has awarded a contract to the H. Wales Lines Company, Meriden, Conn., for constructing a 200-foot dam on the Pascoag River, in connection with extensive hydroelectric developments now under way. W.

SOUTHWICK, MASS.—This town is considering the installing of a street-lighting system. W.

NEW LONDON, CONN. — Shore Line Electric Railway Company has completed plans for a brick and concrete power station, 45 feet by 80 feet, to contain generating equipment which will add about 100 per cent to present output. W.

BUFFALO, N. Y.—The Lehigh Valley Railroad is planning the building of an extensive repair shop in connection with the erection of the new passenger and freight terminals. It is estimated that the shops will cost $250,000, and that electrical equipment will enter to a considerable extent in the fitting up of the machinery.

MARTINSBURG, W. VA. — Reorganization of the Martinsburg Power Company, as the Potomac Light and Power Company, is under way, with $1,000,000 authorized capital. It is given out that the company will expend about $100,000 for improvement of four dams and five plants.

WATERBORO, S. C.—Water works and electric light bonds amounting to $15,000 have been voted. Address H. W. Black, Jr., chairman of Board of Public Works.

COOLIDGE, GA.—Bonds amounting to $4,500 have been voted for extending and improving the electric light plant. Address the mayor.

TITUSVILLE, FLA.—An election will be held September 20 to vote on the question of issuing $35,000 in municipal bonds for purchasing the plant and other properties of the Titusville Electric Light Company. Address L. W. Doolittle, mayor.

NORTH CENTRAL STATES.

CLEVELAND, O.—The W. M. Pattison Supply Company has purchased a tract of land upon which a large warehouse will be constructed. The electrical equipment, it is understood, will be extensive.

CLEVELAND, O. — A mercantile building, eight stories high and costing over $100,000, is to be erected on Huron Road west of East Ninth Street. Goakes & Dettelbach handled the realty operations, and it is understood that there will be a number of contracts for electrical equipment.

COLUMBUS, O.—The Ohio Board of Administration, Columbus, O., of which H. S. Riddle, Columbus, is consulting engineer, will purchase for the Ohio Hospital for Epileptics, at Gallipolis, O., two 400-horsepower water-tube boilers, and two 400-horsepower stokers, and for the Institution for the Feeble-Minded, at Columbus, nine automatic side-feed self-cleaning stokers. Specifications are on file with the board. Bids will be received until September 10 at 2 o'clock p. m. L.

YOUNGSTOWN, O.—It has been announced that the Youngstown Sheet and Tube Company has practically decided upon the erection of another bar mill for the exclusive rolling of iron. It is expected that electrical equipment will enter very largely into the operations.

MONROE, IND.—Bonds to the amount of $4,000 have been voted to build a pole line from Decatur to Monroe. Address Martin Mylott, superintendent of water works.

SPRINGFIELD, ILL. — Business men here are contemplating the installation of an ornamental lighting system on Washington Street, from First to Tenth Streets, and on Monroe Street, from Spring to Tenth Streets. The matter is before the Board of Local Improvements.

BRELA, IOWA.—An electric light plant will be installed here. Address the town clerk.

JOLLEY, IOWA.—The Council is planning to secure a municipal light plant. Address the town clerk.

KANSAS CITY, MO.—The Federal Power Company will be organized with a capital of $4,000,000, to build a series of dams in the Niagara River to furnish electric power to Kansas City, Springfield and other cities of western Missouri. The company is being established by Kelly & Kelly, and C. E. Foote & Son, financial agents for the proposed company that is contemplated to build the dams, install the power plant and operate it.

ST. JOSEPH, MO.—Bond proposals for the issuance of more than a million dollars will be voted on September 23, including proposals for $75,000 for improvements of the local lighting plant. M.

ELLINWOOD, KANS.—The Council is planning ways and means to install a $15,000 electric light plant. Address the town clerk.

HOYT, KANS.—The Council is planning to secure a municipal electric light plant. Address the town clerk.

SOUTH CENTRAL STATES.

CLAY, KY.—The Clay Electric Light and Ice Company is contemplating the addition of a laundry plant to its operations.

ELIZABETHTOWN, KY.—The General Utilities Company has contracted with the Elizabethtown Milling Company to furnish electric power for the mill which is now using an engine. The Utilities Company will install a 24-horsepower motor and a 75-horsepower motor, which it is thought will be sufficient to run the mill.

HENDERSON, KY.—The municipal electric light plant will not be sold while the present administration is in power, according to Mayor Johnson. A new boiler house is to be built soon at the city's plant, to replace that damaged by a storm.

IRVINE, KY.—The Irvine Light Company, which is now equipping a new plant, expects to begin supplying service by September 1.

LANCASTER, KY.—Plans for the municipal electric light plant and water system, previously noted, include the installation of generators of 60 kilowatts and 120 kilowatts, and electric pumps for water works.

WARSAW, KY.—The Warsaw Electric Light and Ice Company, which has practically completed its plant here, will begin service about the last of the month. Many citizens have wired their homes in preparation.

COLUMBIA, TENN.—The Water & Light Company will improve lighting. Address City Engineer Weiss.

HENDERSON, TENN.—The municipal bond issue to construct an electric light plant, water works and sewer system, has carried. J. I. Galbraith is mayor.

LONSDALE, TENN.—An electric lighting installation is contemplated. Dr. H. E. Christenberry is mayor.

PULASKI, TENN. — An ordinance has been passed requiring all telephone, telegraph and electric light poles around the public square to be removed. The city has also voted to pay one-third of the expense of putting in a white way system of lighting.

MARSHALL, OKLA. — Bonds to the amount of $25,000 have been voted to construct an electric light and power plant. Address the mayor.

PURCELL, OKLA.—The city contracted to furnish Lexington, Okla., across the South Canadian River, with electric current both for street lighting and private use. Final action has been delayed however by hesitancy of the Purcell-Lexington Bridge Company to enter into a contract to carry the feed wires across its bridge.

WIRT, OKLA.—W. E. Gupton will organize a company to build an electric light and power plant.

DUBLIN, TEX.—The Dublin Electric and Gas Company will extend the street-lighting system here. D.

LOCKHART, TEX. — The local electric light, water works and ice plant has been purchased by W. B. Tuttle, and associates, of San Antonio, from J. A. Bachman, of Austin, and J. E. Jones, of Lockhart. The plant will be improved and enlarged. Frank E. Scovill is the new manager. D.

SKIDMORE, TEX. — The Texas Southern Electric Company contemplates constructing an electric trans-

mission system from Beeville to Skidmore. Address Fred C. Greer, Beeville, Tex.

VICTORIA, TEX.—The city will issue $40,000 in bonds for electric light plant construction. Address J. H. Flemings, mayor.

WESTERN STATES.

GLASGOW, MONT.—The council plans to install an $18,000 electric plant here. Address H. D. Palmer, city clerk.

ROUNDUP, MONT.—It is reported the City Council, owing to remonstrances filed by voters, has indefinitely tabled the proposition of installing an ornamental lighting system in this city, which was to have cost $10,000.

LEWISTON, IDAHO.—The Commercial Club is reported to be back of the proposition of constructing a municipal power plant on either the Clearwater or Snake Rivers, which would be capable of furnishing current for both lighting and power for this city. Robert S. Erb, president of the Commercial Club, is the moving factor in the project. O.

RUPERT, IDAHO. — According to recent reports, the City Council is contemplating the proposition of acquiring, improving and extending the local electric light plant and distributing system. O.

SALT LAKE CITY, UTAH. — A petition has been presented to the City Commission by Herbert S. Auerbach for the creation of a special lighting district to include the major portion of the business district of the city.

DEXTER, N. M.—The City Council plans to construct a municipal electric light and power plant. D.

FLORENCE, ARIZ.—Plans for an electric light and water system for this city have been submitted to the City Council by F. H. Ensign, of Phoenix. The estimated cost is $46,000.

ARTESIA, CAL.—At a recent election the proposition for the formation of a lighting district for Artesia was carried.

FRESNO, CAL.—Plans are under consideration for the installation of an electrolier lighting system in Courthouse Park, which, it is estimated, will cost $6,500.

SAN DIEGO, CAL.—Plans for an ornamental lighting system on lower Broadway, from California Street to the municipal pier, have been submitted to the City Council by Engineer Cromwell. The cost will be $4,839.

BEND, ORE.—At a recent election the voters refused to grant the electric light and power franchise sought by Steidl & Tweet, who proposed to compete in this field with the Bend Water, Light and Power Company. Charles R. Brown, of Chicago, president of the Bend Water, Light and Power Company, stated that his company, as a result of the defeat of the franchise, will proceed with extensions and improvements necessitated by the rapid growth of the town. From reports it is learned these extensions will be made at once. O.

FRIEND, ORE.—The Friend Mill and Improvement Company has been granted a permit by State Engineer John H. Lewis, for the use of waters of Jordan Creek, same to be used in irrigating about 1,000 acres of land lying in Wasco County, near this place. The company purposes constructing a small electric power plant, which will cost in the neighborhood of $7,000. O.

HAINES, ORE.—It is reported the local flouring mills are to be equipped with new electrical machinery at an early date. M. Moeller, of Baker, Ore., owner of the plant, states same will be ready for operation some time this fall. O.

BELLINGHAM, WASH.—The mayor and city comptroller have been instructed by the City Council to enter into a contract for furnishing current with the Whatcom County Railway, Light and Power Company, which is a subsidiary of the Puget Sound Traction, Light and Power Company, of Seattle, and is managed by Leslie Coffin. The council has also voted to install a new street-lighting system this fall. O.

OLYMPIA, WASH.—The Board of County Commissioners, of Thurston County, at a recent meeting, granted a franchise to George Tilden, Hoge Building, Seattle, to construct, operate and maintain electric power lines in Thurston County. According to plans heretofore announced, Tilden will erect a hydroelectric power plant on the Skokomish River, in Mason County, and will transmit the current generated throughout southwestern Washington, serving the small towns as well as the larger ones with current for both light and power. O.

SOUTH BEND, WASH.—The Willapa Power Company, serving this city and contiguous territory, will shortly begin the first unit of a proposed hydroelectric power plant on the South Fork, which will supply all necessary electricity for local consumption. The company at present obtains its current from a local mill plant. The company is composed of local capital.

SUMNER, WASH. — The Puget Sound Traction, Light and Power Company, Seattle, has announced its intention of installing a new lighting system in the immediate future.

FINANCIAL NOTES.

The Federal Telephone & Telegraph Company has filed a mortgage of $25,000,000. It operates an independent telephone system in Rochester, Buffalo and western New York.

At the annual meeting of American Public Utilities Company retiring directors were re-elected with the exception that Walter H. Lippincott replaced Henry S. Morris, of Philadelphia. Willis J. Ripley, who has been assistant treasurer, was elected treasurer. Other officers were re-elected.

Dividends.

	Term	Rate	Payable
Cent. Miss. Val. Elec. pf.	Q	$1.50	Sept. 1
General Elec.	Q	2 %	Oct. 15
Louisville Traction pf.	S	2.5 %	Oct. 1
Louisville Traction com.	Q	1 %	Oct. 1
No. Ohio Traction	Q	1.25%	Sept. 15

Reports of Earnings.

CONSUMERS' POWER OF MICHIGAN.

	1915	Per cent gain over 1914
July gross	$ 305,310	18.17
Net earnings	198,176	20.90
Surplus after charges	107,712	56.87
Balance after preferred dividends	74,212	91.95
Seven months' gross	2,126,068	9.65
Net earnings	1,441,347	12.22
Surplus after charges	779,366	23.33
Balance after preferred dividends	544,866	26.14
Twelve months' gross	3,602,490	8.43
Net earnings	2,373,897	17.80
Surplus after charges	1,236,593	36.38
Balance after preferred dividends	845,093	48.46

CLEVELAND ELECTRIC ILLUMINATING.
(Central States Electric Corp. Subsidiary.)

	1915	1914
July gross	$ 311,643	$ 291,489
Net after taxes	152,010	140,847
Balance after interest, preferred dividends and amortization	116,580	105,107
Surplus after depreciation	85,415	75,957
Seven months' gross	2,585,581	2,540,097
Net after taxes	1,352,132	1,182,650
Balance after interest, preferred dividends and amortization	1,104,118	928,440
Surplus after depreciation	818,558	670,785
Twelve months' gross	4,301,428	4,262,682
Net after taxes	2,089,966	2,006,324
Balance after interest, preferred dividends and amortization	1,670,078	1,585,493
Surplus after depreciation	1,239,934	1,159,234

CITIES SERVICE COMPANY.

	1915	1914
July gross	$ 297,626	$ 271,637
Net after expenses	283,255	262,675
Balance after interest	242,422	221,842
Surplus after preferred dividends	111,589	85,009
Twelve months' gross	4,003,722	3,543,737
Net after expenses	3,850,143	3,446,468
Balance after interest	3,360,143	3,125,477
Surplus after preferred dividends	*1,766,147	1,703,352

*Equivalent to 11.84 per cent on common stock.

MONTREAL LIGHT, HEAT & POWER.

	1915	1914
July gross	$ 474,879	$ 460,903
Net after taxes	255,186	233,992
Surplus after charges	214,577	198,316
Three months' gross	1,509,506	1,454,166
Net after taxes	831,888	768,125
Surplus after charges	709,892	662,812

ALABAMA POWER COMPANY.

	1915	1914
July gross	$ 86,014	$ 45,645
Expenses and taxes	35,390	23,508
Net earnings	50,624	22,140
Twelve months' gross	900,599	456,169
Expenses and taxes	371,009	281,274
Net earnings	529,590	174,895

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 23	Aug. 16
American Tel. and Tel. (New York)	121	122¾
Commonwealth Edison (Chicago)	135	135
Edison Electric Illuminating (Boston)	230	233
Electric Storage Battery common (Philadelphia)	62¾	62½
Electric Storage Battery preferred (Philadelphia)	62¾	62½
General Electric (New York)	168	171
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	4⅝	4½
Massachusetts Electric preferred (Boston)	33¾	33¼
National Carbon common (Chicago)	140	145
National Carbon preferred (Chicago)	119¾	119¾
New England Telephone (Boston)	131	132
Philadelphia Electric (Philadelphia) (ex-dividend)	24¼	24¼
Postal Telegraph and Cables common (New York)	70	76½
Postal Telegraph and Cables preferred (New York)	66¾	66¾
Western Union (New York)	69⅞	71
Westinghouse common (New York)	111⅛	112⅝
Westinghouse preferred (New York)	135	137½

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 17,976. ELECTRIC MOTORS.—An established firm in Norway informs an American consular officer that it desires to represent American manufacturers of electric motors.

NO. 17,979. ELECTRICAL SUPPLIES, ETC.—An American consular officer in the Netherlands states that a firm in his district desires to represent American manufacturers of electric motors, telephones, geometrical and other technical instruments.

NO. 18,006. ELECTRICAL SUPPLIES.—An American consular officer in China reports that he has been requested to supply catalogs and full information relative to electrical supplies. Correspondence may be in English.

NO. 18,031. INCANDESCENT LAMPS.—An American consular officer in France writes that a business man in his district desires to represent American manufacturers and exporters of incandescent lamps. Correspondence is preferred in French.

NO. 18,032. ELECTRIC LAMP SOCKETS.—An Italian manufacturing company informs an American consular officer that it is in the market for 60,000 screw sockets per month. Contracts for a year or longer will be entered into. Reference is given. It is stated that samples are being forwarded. When the samples arrive they will be exhibited at the branch offices of the Bureau.

NEW INCORPORATIONS.

SPILLVILLE, IOWA.—The Spillville Electric Light Company has been incorporated with a capital of $10,000.

SUPERIOR, WIS.—The Ross Electric Company has been incorporated with a capital of $10,000, by Leslie G. Ross, F. J. Goodwin and R. I. Tinton.

NEW YORK, N. Y.—Daylite Electric Corporation; electrical fixtures. Capital, $1,000. Incorporators: Walter H. Strong, Max D. Boiko and Abraham M. Fisch.

BOSTON, MASS. — The Rendle-Stoddard Company has been incorporated for the purpose of waterpower development, with a capital of $50,000. The incorporators are James B. Rendle and Clayton Stoddard.

PORTLAND, ME.—The Allen Electrolytic Cell Corporation has been incorporated with an authorized capital of $50,000. The directors are Messrs. Freeman. E. N. Gibson and Charles N. Drummond, all of Portland.

CORTLAND, N. Y.—The Southwick Electric Company has been incorporated with a capital of $5,000, to deal in electrical supplies, etc. The incorporators are Charles H. Moss, Lee Southwick and Edith Phillips.

NEW YORK, N. Y.—The New York Switch and Panel Board Company, Incorporated; to manufacture switchboards and other electrical goods. Capital, $25,000. Incorporators: J. Walter Smith, Frederick Weierman and John F. P. Young.

SUMMIT, N. J.—The Commonwealth Electric Company has been incorporated with a capital of $500,000. Carroll P. Bassett, Frank C. Kimball, Stephen W. Borden, H. Marsh Shorrock, all of Summit, and Fred R. Drake, Easton, Pa., are incorporators. A.

WELLESLEY, MASS.—The Fuller Electrical Appliance Company has been incorporated and will engage in the manufacture of electric specialties. The incorporators are: F. A. McClaskey, president; L. D. H. Fuller, M. D. Maher, C. L. Maher and H. A. Weitz.

LANCASTER, O.—S. S. Wilson and Roy Ballinger, promoters of an automatic electric lighting system, with S. K. Weirick, J. J. Klise and W. P. Nolder, have just taken out from the office of the secretary of state incorporation papers for the Automatic Lighting and Power Company. The capital stock is $50,000.

NEW PUBLICATIONS.

COMMERCIAL TREATIES.—The National Foreign Trade Council has published a brief by Carman F. Randolph entitled, "Commercial Treaties of the United States." This has been prepared under the direction of the Foreign Relations Committee and considers the conditions which will obtain and the responsibilities which will fall upon the United States on account of the present war.

ALBERTA LIGNITE.—The Canadian Department of Mines has published bulletin No. 331 entitled "Results of the Investigation of Six Lignite Samples Obtained from the Province of Alberta," by B. F. Haanel and John Blizard. This report covers 110 pages and gives the results of tests made upon gas producers using this fuel, as well as of boiler tests. The report is accompanied by tables and illustrations.

GUIDE BOOKS.—The United States Geological Survey has prepared two guide books of the Western United States which are designated as Bulletins Nos. 611 and 612. The first is material referring to the route of the Northern Pacific Railroad to the Pacific Coast and the second the Overland Route, and both include side trips to Yellowstone Park. They contain useful and interesting information for the public, but are concerned chiefly with geological features along the respective routes. They may be obtained from the Superintendent of Documents, Washington, D. C., for $1.00 each.

PERSONAL MENTION.

MR. G. W. MILLIKEN, superintendent of the Arkansas Valley Railway, Light & Power Company, at La Junta, Colo., has been re-elected secretary of the La Junta Merchants' Association.

MR. DONALD M'DONALD, vice-president and general manager of the Louisville Gas and Electric Company, who has been spending some time at Hot Springs, Va., where his family is spending the summer, has returned to Louisville.

MR. M. L. HIBBARD, general manager of the Union Light, Heat & Power Company, Fargo, N. D., was recently re-elected a member of the Board of Directors of the Merchants Auxiliary of the North Dakota State Fair Association, and Mr. W. P. Chestnut, new-business manager of the company, was elected secretary-treasurer of the Auxiliary.

MR. JAMES H. BETTS, sales manager of Betts & Betts Corporation, New York, announces his candidacy for the office of congressman for New York in the fourteenth Jovian administration. Mr. Betts has been an active worker in the Jovian Order for a number of years. He was formerly a statesman-at-large and is now statesman for New York.

MR. M. B. WHEELER, general manager of Cummings & Company, Incorporated, jobbers, Galveston, Tex., is enjoying a season of hard work and meeting with considerable success in bringing his company to a leading position as a distributor of electrical and automobile accessories, sporting goods, etc. Mr. Wheeler, who for many years was connected with the Tel-Electric Company has many friends in the electrical business who will be glad to know of his continued success.

MR. W. C. WHITNEY BEATTIE will hereafter be located at the New York office of the American Rotary Valve Company, 30 Church Street, in capacity of industrial engineer. Mr. Beattie, who became connected with the company last spring, is regarded as an expert in motor and control application, and in the electrical equipment of driven machinery. He was for several years director of the Sprague Electric Works' New York office, printing machine equipment division.

MR. WILLIAM D. AINEY, of Montrose, Susquehanna County, has been appointed chairman of the Public Service Commission of Pennsylvania by Governor Brumbaugh. Mr. Ainey, who was appointed a commissioner in the spring of 1915, has been acting as chairman, being the junior in the commission. The newly appointed chairman has served as a United States congressman, and was a member of the House Committee on Foreign Relations. He was born at New Milford, Pa., and is a graduate of Mansfield Normal School and Lehigh University. He was district attorney of Susquehanna County for two terms until elected as a congressional representative.

MR. V. C. GILPIN announces a departure in the selling of electrical merchandise which he expects will make an immediate appeal to both the electrical manufacturer and dealers throughout the country. The new business is styled "Gilpin, V. C. Company, Brokers in Electrical Merchandise," with offices at 110-112 West Fortieth Street, New York City. He purposes securing from the various manufacturers of electrical material, a list of their slow-selling, obsolete types, dead stocks, mill-ends, overproductions, etc., listing them under respective headings, showing net cash prices and mailing them to his customers. He expects to have his first list ready for mailing about September 10.

MR. THOMAS C. RINGGOLD, for many years well and favorably known in the electrical industry and formerly general sales manager of the Central Electric Company, Chicago, has made an important connection in an entirely new line. Mr. Ringgold has recently been appointed superintendent of agencies of the Kerner Incinerator Company, of 124 Biddle Street, Milwaukee, Wis. and is busy establishing branch offices and appointing district agents. While this work will take him

away from the electrical field, his wide knowledge of the business will stand him in good stead in the new connection, as he will have to do to a considerable extent with building contractors and the architectural fraternity. The Kerner incinerator is a recently perfected device for entirely removing in an economical and efficient manner all house refuse, and is finding immediate popularity in high-class residences in every part of the country.

MR. PIERRE L. MILES, sales manager of the electrical department of the Globe Stove and Range Company, Kokomo, Ind., started in the electrical business with the master mechanic of the Cleveland Electric Railway Company some six years ago. In 1908 he entered the employ of the Cleveland

P. L. Miles.

Electric Illuminating Company in the executive offices. Later on he entered the sales department and after considerable experience in various divisions took charge of advertising and appliance sales. His work at this time attracted a great deal of attention, and in 1912 he was offered a position with the National Electric Lamp Association, Cleveland, O., spending the major portion of his time with this organization traveling to different parts of the country studying the new-business methods of various progressive central stations. Early in 1915 he took charge of the house-wiring, advertising and appliance departments of the Indianapolis Light and Heating Company, initiating one of the most successful campaigns which this aggressive organization has undertaken. He then joined forces with the Globe Stove and Range Company. This organization has enjoyed a prominent position in the coal and gas stove business for many years and is now entering the field with a complete line of electrical stoves and ranges. Mr. Miles is alert and active, has made many friends in the electrical industry, is an affable and magnetic salesman and has already done much to establish the popularity of his new connections. He has entire charge of marketing the electrical product, and for the time being will make his selling headquarters in the Commonwealth Edison Building, Chicago, Ill.

DATES AHEAD.

Indiana Electric Light Association. Annual convention, Hotel Deming, Terre Haute, Ind., September 8-10. Secretary, T. Donahue, La Fayette, Ind.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., September 8-10. Secretary, H. N. Mueller, 435 Sixth Avenue, Pittsburgh, Pa.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

Northwest Section, National Electric Light Association. Annual convention, Portland, Ore., September 8-11. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

Association of Edison Illuminating Companies. Annual convention, Spring Lake, N. J., September 13-16. Secretary, George C. Holberton, San Francisco, Cal.

Electrical Supply Jobbers' Association. Quarterly meeting. Clifton Hotel, Niagara Falls, Ont., September 14-16. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

New England Section, National Electric Light Association. Annual convention, Mt. Kineo House, Kineo, Me., September 14-17. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

American Institute of Electrical Engineers. Panama-Pacific convention, San Francisco, Cal., September 16-18. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

American Electrochemical Society. Twenty-eighth general meeting, San Francisco, Cal., September 16-18. Secretary, Joseph W. Richards, South Bethlehem, Pa.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcroft Building San Francisco, Cal.

American Mining Congress. Eighteenth annual convention, San Francisco, Cal., September 20-22. Secretary, J. F. Callbreath, Munsey Building, Washington, D. C.

Illuminating Engineering Society. Annual convention, New Willard Hotel, Washington, D. C., September 20-23. Assistant secretary, Joseph Langan, 29 West Thirty-ninth Street, New York, N. Y.

Telephone Pioneers of America. Annual meeting, San Francisco, Cal., September 21-23. Secretary, R. H. Starrett, 15 Dey Street, New York, N. Y.

Southeastern Section, National Electric Light Association. Annual convention, Grove Park Inn., Asheville, N. C., September 22-24. Secretary, George H. Wyeant, Tampa, Fla.

Colorado Electric Light, Power and Railway Association. Thirteenth annual convention, Glenwood Springs, Colo., September 23-25. Secretary, Thomas F. Kennedy, 900 Fifteenth Street, Denever, Colo.

American Electric Railway Association. Annual convention. San Francisco, Cal., October 4-8. Secretary, E. B. Burritt, 8 West Fortieth Street, New York, N. Y.

Jovian Order. Thirteenth annual convention, Hotel Sherman, Chicago, Ill., October 13-15. Mercury, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Electric Vehicle Association of America. Annual convention. Cleveland, O., October 18-19. Executive secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

The Kuhlman Electric Company, manufacturers of transformers, is moving its plant from Elkhart, Ind., to Bay City, Mich., into a modern factory. The company should be addressed at Bay City from this date.

Columbia Lamp Division of the National Lamp Works of General Electric Company, St. Louis, Mo., has removed its offices to Suite 1201, Title Guaranty Building, 706 Chestnut Street.

The P. & B. Manufacturing Company, Milwaukee, Wis., manufacturers of electrical fittings and heating appliances, announces that A. Hall Berry, 87 Warren Street, New York City, is acting as sole agent for the Sun Ray electric heating pad.

The ADAPTi Manufacturing Company, Cleveland, O., has ready for distribution catalog No. 105, effective September 1, giving full descriptions and prices on ADAPTi boxes. This apparatus is listed in complete units assembled to make the various types most commonly used and that are well known to the trade. A perusal of this catalog constitutes a liberal education in interesting conduit fittings. Copies of the catalog will be supplied to those interested upon request.

W. R. Ostrander and Company, New York, N. Y., announces that the National Board of Fire Underwriters has recently approved an Ostrander bell for service on 50 to 250-volt circuits. This bell is of the vibrating type, and is manufactured in sizes from 2.5 to 24-inch gongs, and is especially designed for fire alarm, railroad and school signals. The Ostrander bell circular will be mailed upon request.

The Turner Electrical Supply Company, Birmingham, Ala., it is announced, has been formally transferred to Young & Vann, who will conduct the business in the future. It is

understood that Oscar Turner and John Turner have severed all connections with the business and are arranging for activities in another line. The Turner Electrical Supply Company, formerly the Southern Wesco Company, is one of the largest business concerns of this kind in Birmingham, dealing in all kinds of electrical supplies and automobile accessories.

The New Process Gear Corporation, Syracuse, N. Y., by negotiations closed between T. G. Meachem, vice-president of the company, and the officers of the Union Typewriter Company, has acquired ownership of the Monarch Typewriter plant, Syracuse, N. Y. The buildings of the Monarch plant cover two acres, and the surrounding land which adioins the property of the New Process Gear Corporation includes an additional three acres. The main building is five stories high, is of brick and slow-burning mill construction, with a frontage of 480 feet and extending back 350 feet. After alterations the Monarch plant will be used as a job, gear and spur and transmission gear department, and the present plant will be devoted exclusively to the manufacture of automobile differentials. It is the intention of the New Process Gear Corporation to have more than 1,000 employees at work before spring, at which time the additional five-story building now being erected on property purchased recently will be completed and equipped.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., announces that it has received the following among recent orders: Johnstown Traction Company, Johnstown, Pa., one 300-kilowatt, 60-cycle, alternating-current, self-starting rotary converter; one 300-kilovolt-ampere, three-phase, 22,000-volt transformer and two-panel switchboard. Toledo Railway and Light Company, Toledo, O., one 1,500-kilowatt, six-phase, 25-cycle, commutating-pole rotary converter and three 500-kilovolt-ampere transformers. City of Cleveland, O., two 1,000-kilowatt, 270-volt direct-current, six-phase, 60-cycle, synchronous booster converters, alternating-current self-starting; six 365-kilovolt-ampere, 11,000-volt transformers and 12-panel switchboard. Philadelphia Suburban Gas and Electric Company, one 500-kilowatt, 600-volt, direct-current, three-phase, 60-cycle, alternating-current, self-starting rotary converter: three 110-kilovolt-ampere, 13,200-volt transformers. Metropolitan Street Railway Company, Kansas City, Mo., one 3,000-kilowatt, 575-volt, direct-current. six-phase, 25-cycle, commutating-pole rotary converter; three 1,000-kilovolt-ampere, 6,600-volt, air-blast transformers; one blower outfit for the above transformers and three-panel switchboard. Commonwealth Edison Company, Chicago, Ill., one 4,000-kilowatt, 600-volt direct-current, six-phase, 25-cycle, commutating-pole rotary converter; one 4,200-kilovolt-ampere, three-phase, 25-cycle, air-blast transformer (9,000 volts to rotary voltage); one switchboard for control of this apparatus. Pittsburgh Railway Company, Pittsburgh, Pa., four 1,800-kilowatt, 600-volt, direct-current, six-phase, 60-cycle, commutating-pole rotary converters; twelve 625-kilovolt-ampere 11,000-volt transformers; one 33-panel switchboard to control the above apparatus; also three motor-generator sets with 1,000-kilowatt, 550-volt, direct-current commutating-pole generators and three-phase, 60-cycle, 10,000-volt synchronous motors and direct-connected exciters. St. Louis, Rocky Mountain & Pacific Railway Company, Raton, N. M., one portable substation complete. containing one 300-kilowatt, 250-volt, direct-current, commutating-pole generator with one 450-horsepower, three-phase, 60-cycle, 2,300-volt synchronous motor as a motor-generator set; three 100-kilovolt-ampere, 44,000-volt outdoor transformers and a two-panel switchboard.

Record of Electrical Patents

Issued by the United States Patent Office, August 17, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,150,007. Electrical-Impulse Transmitter. W. Aitken, assignor to Relay Automatic Telephone Co., London, England. Self-contained for automatic telephone system.

1,150,009. Telephone Set. W. P. Andrick, assignor to General Acoustic Co., New York, N. Y. Receiver has several windings respectively connected with several transmitters.

1,150,010. Centrifugal Switching Device. S. L. Armstrong, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Details of centrifugal weight device.

1,150,017. Vapor Rectifier. D. C. Davis, assignor to Westinghouse Electric & Mfg. Co. Rectifying circuit in evacuated container inductively connected with exterior circuit.

1,150,019. System for Electrical Distribution. J. B. Dyer and G. A. Johnstone, Anderson, Ind. Regulation of storage-battery system.

1,150,021. Molding Electrodes. G. Favier, Suspension Bridge, N. Y. Electrodes have concentric zones of material increasing in porosity toward the center.

1,150,022. Coil Wedge. A. B. Field, assignor to Westinghouse Electric & Mfg. Co. Coil-retaining wedge for open-slot dynamo-electric machine.

1,150,023. Secondary or Storage Battery. B. Ford, Philadelphia, Pa. Containers made in sections and respectively connected to plates of opposite sign; details of insulation, plate supports, etc.

1,150,028. Photographic-Studio-Lighting Apparatus. E. Goldensky and P. H. Bartlett, Philadelphia. Lamps at intersections of lazy-tongs frame can be compacted or dispersed to vary light intensity.

1,150,032. Starting Ignition System for Internal-Combustion Engines. O. Heins, New York, N. Y. Special starting ignition circuit controlled by cranking means.

1,150,035. System of Control. H. D. James, assignor to Westinghouse Electric & Mfg. Co. Electromagnetic control of resistances respectively in series and shunt with motor.

1,150,043. Dynamo-Electric Machine. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Supports for armature coil ends.

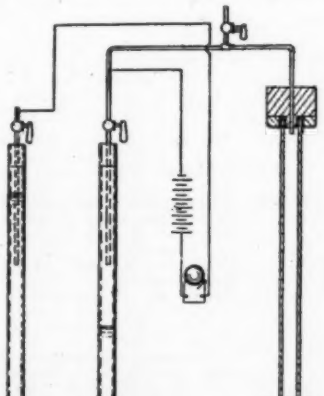
1,150,049. Laminated Structure. F. S. Martin, assignor to Westinghouse Electric & Mfg. Co. Plates of core structure have magnetic retaining strips imbedded in and welded to them.

1,150 053. Display Apparatus. C. G. Miller, assignor to Underseller Co., New York, N. Y. Electric motor-driven advertising device.

1,150,054. Electric Signaling Apparatus. E. G. Missbach, assignor to Siemens & Halske Aktiengesellshaft, Berlin, Germany. For sending combination signals.

1,150,055. Telephone System H. W. Munsell, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Particular arrangement of relays in link circuit.

1,150,066. Pocket Flashlight. F. M. Rosenfeld, assignor to Import Sales Co., New York, N. Y. Has clip for preventing loss from pocket and serving as switch.



No. 1,150,204.—Burglar Alarm.

1,150,067. Supporting Structure for Trolley Conductors. W. Schaake, assignor to Westinghouse Electric & Mfg. Co. Steadying arm for catenary line.

1,150,081. Method of Making Electrical Apparatus. S. Trood, assignor to Westinghouse Electric & Mfg. Co. For casting head about insulated coil of soldering iron.

1,150,101. Method for Cleaning Articles. E. L. Couch, assignor to Couch-Dean Corporation, Hartford, Conn. Article is positioned upon an electrode and placed in an electrolytic circuit.

1,150,110. Automatic Signal-Operator. E. R. Gill, assignor to Hall Switch & Signal Co., New York, N. Y. Sender normally and automatically sending rapid succession of impulses has operation interrupted by key-controlled arrester.

1,150,111. Coherer. E. R. Gill, Yonkers, N. Y., assignor to T. M. Campbell. Particular structure of terminal bodies forming cavity between them in which are located the coherable particles.

1,150,112. Plug Switch. W. S. Hadaway, Jr., and E. E. Rose, assignors to Westinghouse Electric & Mfg. Co. Telescoping cylindrical shells respectively carry co-operating plug and socket members.

1 150,116. Battery-Charging System. J. O. Heinze, Detroit, Mich. Arrangement of magnets in shunt circuits about dynamo for controlling circuit connections.

1,150,117. Treatment of Water and Other Liquids by Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen, assignors to R. U. V. Co., New York, N. Y. Liquid flowing through chamber subjected to rays emitted from mercury-vapor lamp and flow of liquid is reduced when lamp current is larger than normal.

1,150,118. Art of Lighting. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. A wave-transforming reflector comprising translucent sheet carrying a fluorescent coating and backed by a reflecting surface.

1,150,150. Machine for Electrically Welding the Links of Chains, Rings or the Like. M. B. Ryan, Bridgeport, Conn. Details of machine for resistance welding.

1,150,169. Electric Motor. S. C. Bryant, assignor to Bryant Zinc Co., Chicago, Ill. Arrangement of solenoids, etc., to form motor for operating signal pendulum.

1,150,170. Headlight. F. Buchanan, Syracuse, N. Y. Particular provisions for adjusting lamp along focal axis of reflector.

1,150,204. Electrical Alarm System. A. Julian, Seattle, Wash. Compressed air between double windows holds alarm circuit open. (See cut.)

1,150,239. Combined Automatic Burglar and Fire-Alarm System and Telephone Service. O. Asmussen, Brooklyn, N. Y. Terminal station for interconnecting main lines of systems described, is controlled from central, and any subscriber can be locked out at will by central.

1,150 266. Telephone Transmitter. W. Harrison, Brooklyn, N. Y. Sound waves projected against arc in transmitter circuit and means provided for subjecting the arc to a varying magnetic field to amplify the sound-wave effect.

1,150,267. Apparatus for Transmitting Sounds. W. Harrison. Sound waves directed into hollow electrode forming a

terminal for arc in transmitter circuit, thus subjecting position particularly sensitive to ionization to the action of varying ionizing force.

1,150,270. Support for Incandescent-Lamp Filaments. H. W. Jackson, assignor to Westinghouse Lamp Co., New York, N. Y. Particular structure of resilient support maintaining metal filament under tension.

1,150,271. Electric Reduction of Zinc Ores. W. McA. Johnson, assignor to Continuous Zinc Furnace Co., Hartford, Conn. Treatment of complex zinc ores including sulphur, lead and calcium or barium.

1,150,272. Method of Telegraphic Transmission. C. Kinsley, Chicago, Ill. Relates to printing electrical signals transmitted at high speed.

1,150,275. Single-Piece Shell for Electric Light Sockets. H. W. Lawrence, Denver, Colo. Integral shell having groove extending from open end to key-hole for guiding switch mechanism in assembling.

1,150,307. Normally Closed Cab-Signal Circuit. P. J. Simmen, San Francisco, Cal. Signal circuit includes two signals, one or the other of which is operated by wayside devices.

1,150,308. Mechanism or Apparatus for Controlling, Retarding, and Arresting the Motions of Engines or Vehicles When Traveling. P. J. Simmen. Devices in the cab for controlling the locomotive speed are operated by wayside means.

1,150,309. Means for Controlling the Movement of Vehicles. P. J. Simmen. Retarding means controlled by speed governor on locomotive in conjunction with wayside devices.

1,150,313. Electric Fan. C. P. Banzhof, B. G. Stauffer, and C. F. Stauffer, assignors of one-fourth each to said parties and one-fourth to L. W. Horting, Lancaster, Pa. Is rotatable automatically at different speeds to produce gusts of wind.

1,150.316. Electrical Relay. A. F. Sykes, New Barnet, England. Stream of liquid is part of electric circuit and has its conductivity changed by varying proportion

No. 1,150,590.—Electrolytic Arrester.

of conductivity jet introduced into the stream.

1,150,326. Electromagnetic Recording Apparatus for Telegraph Circuits. A. H. Annand, Buenos Aires, Argentina. Details of electromagnetic tape perforation.

1,150,344. Fuse. A. F. Daum, Pittsburgh, Pa. Details of refillable plug fuse.

1,150,350. Projection Apparatus. C. F. Dussaud, Paris, France. Particular structure of incandescent lamp and arrangement of lenses.

1,150,356. Circuit-Controller. T. T. Gaff, Washington, D. C. Periodically interrupted circuit for actuating an indicator is thermostatically controlled.

1,150,370. Electrolytic Cell. H. C. Jenkins, London, England. Particular arrangement of electrode and devices for drawing off liquid and gaseous products.

1,150,372. Lineman's Climber. C. M. Jones, Carrollton, Miss. Details of device having leg-engaging and heel-engaging parts.

1,150,377. Automatic Trainstop. J. H. K. McCollum, Toronto, Ont., Canada. Operation of brakes controlled by condition of signaling system.

1,150,390. Electric Water-Heater. R. C. Sage, Arrowrock, Idaho. Connections and support of resistor coils in metal water chamber.

1,150,391. Lamp. A. J. Sanford, assignor to A. H. Heisey & Co., Newark, O. Standing lamp with special structure of conductor conduit, lamp support, etc.

1,150,392. Spark Plug. I. H. Sare, Sentinel, Okla. Structural details of plug having spreader ring.

1,150,395. Telegraphic Transmission. C. Schou, Holte, Denmark. Structure of contactor for automatic transmission.

1,150,413. Illuminating Attachment for Telephones. J. Berry and D. T. Odineal, Lexington, Va. Lighting circuit controlled by telephone hook.

1,150,416. System of Distribution. L. E. Bogen and L. C. Nichols, assignors to Allis-Chalmers Mfg. Co., Milwaukee, Wis. For operating rotary converters from polyphase circuit.

1,150,426. Electric Heater. W. S. Hadaway, Jr., New Rochelle, N. Y. Manner of securing heating resistance to heated member.

1,150,427 and 1,150,428. Electric Iron. W. S. Hadaway, Jr. First patent, application of above to flatiron with provision for confining the heat. Second patent, details of structure in which resistor is welded to heated plate.

1,150,429. Electric Heater. W. S. Hadaway, Jr. Cast metal heating surface has heat-conducting resistor carrier imbedded therein.

1,150,431. Electric Iron. A. E. Heineman, Los Angeles, Cal. Spring-pressed rotatable handle tends to open circuit but can be latched in closed-circuit position.

1,150,434. Lamp Socket and the Like. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Means for locking two-part casing and base against relative rotation.

1,150,436. Aerial Propeller. A. A. D. Lang, London, England. An electrically deposited metal sheathing covers end of blade and unites with metal band in a groove encircling the blade.

1,150,453. Automatic Time Cutoff. A. J. Richardson, Long Beach, Cal., assignor of one-half to J. Lyle. Details of time-operated switch mechanism.

1,150,463. Ignition Device for Explosive Engines. H. R. Stuart, assignor to Robbins & Myers Co., Springfield, O. Means for separately exciting magneto during starting.

1,150,486. Brush-Holder. C. O. Bregstrom, assignor to B. F. Sturtevant Co., Boston, Mass. Brush box adjustable to receive brushes of different sizes.

1,150,494. Signal System. J. P. Buchman and F. B. Wiegand, Cleveland, O. Circuit details of railway block system.

1,150,519. Motor Cabinet. N. H. Holland and N. C. Durand, assignors to New Jersey Patent Co., West Orange, N. J. For phonographs; incloses driving motor and resistance controller therefor.

1,150,520. Magneto-Electric Generator. N. M. Hopkins, assignor to Electric Tachometer Co., Philadelphia, Pa. Structure of device of inductor type.

1,150,528. Sash Holder and Burglar Alarm. C. C. Lott, Hattiesburg, Miss. Details of device controlled by window sash for closing bell circuit.

1,150.530. X-Ray Tube. R. H. Machlett, New York, N. Y. Particular structure and arrangements of tube, cathode, anode and cathode shield.

1,150,542. Automatic Balancing and Steering Device. C. T. Ryland, Sonoma, Cal. Tilting of vehicle controls operation of motor and its connection to steering post.

1,150,545. Current Control for Motor Vehicles. B. F. Schmidt, Exeter, Cal. Ignition system has alternative electrical sources, the switch for connecting them being interlocked with spark-advancing and retarding means.

1,150,552. Focusing Device for Electric Lamps. J. C. Stearns, Worcester, Mass. For adjusting lamp along focal axis of reflector.

1,150,562. Electrically Controlled Vaporizer for Internal-Combustion Engines. W. F. Vose, assignor of 49 one-hundredths to T. J. Kimbel, Bloomington, Ill. Engine controls electromagnetic valve regulating fuel supply to mixing valve.

1,150.569. Fuse. W. C. Banks, assignor to N-W Equipment Co., New York, N. Y. End caps of cartridge wedge the fuse-gripping members.

1,150,590. Electrolytic Lightning-Arrester. G. Giles, Fribourg, Switzerland. Comprises chain of aluminum links in solution which forms insulating film on surfaces of links when they are subjected to difference of potential. (See cut.)

1.150.642. Process of Manufacturing Condensation Products From Formaldehyde and Phenol. H. Stockhausen, Crefeld, and R. Gruhl, Charlottenburg, Germany. Consists in heating formaldehyde with phenol until liquid product is formed, mixing this with ferric chloride to form plastic, moldable mass, and heating the mass.

1.150.652. System of Electrical Distribution. E. F. W. Alexanderson, assignor to General Electric Co., Schenectady, N. Y. Polyphase devices are operated from single-phase source through phase converter.

1,150.670. Treatment of Refractory Metals. G. Gmür-Zehnder, Aarau, Switzerland. Electric furnace employed for producing pure malleable and ductile tungsten by fusing the metal to fluid state by radiant heat and then rapidly cooling by cold blast.

1,150,676. Electric Apparatus for Motor-Vehicles. E. A. Halbleib, assignor to North East Electric Co., Rochester, N. Y. Dynamo-electric machine connected with engine shaft is mounted in front of automobile radiator.

1,150,697. Insulator. Z. W. Meely and G. A. Lewis, Rayland, O. Pin type; has head and base sections adapted to receive wires between them.

1,150,698. Switch. A. E. Newman, Sheguindah, Ont., Canada. Circuits successively closed through commutator and brush, with provision for removing brush from commutator or placing it in contact therewith.

1,150,706. Thermal Switch. M. C. Ryan, Phoenix, N. Y. Contacts carried by pair of arched bars one of which carries coil heat from which springs bar to separate contacts.

1,150,738. Incandescent Electric Lamp. J. H. Birch, Gatliff, Ky. Special arrangement of concentric filaments and reflector on bulb.

1,150,765. Telegraphic-Tape Perforator. O. Hoenack and H. Hoenack, assignors to R. H. Sellers Co., New York, N. Y. Key-controlled, magnetically operated punches.

1,150,786. Apparatus and Method for Producing Nitric Acid. H. D. Rankin, assignor to Rankin Process Co., Phoenix, Ariz. Current from high-tension, induction coil supplied to terminals on reciprocating and rotating head in compressed-air chamber to produce electric flame therein.

1,150,796. Searchlight Firearm. E. S. Ward, assignor to Oregon Electric Gun Co., Portland, Ore. In a gun carrying battery, lamp, etc., lens tube extending along barrel is adjustable and push controlling lamp circuit may be adjusted to be operated by hammer cocking.

1.150.798. System of Railway Signals. E. C. Wood, assignor to Submarine Signal

No. 1,150,835.—Insect Trap.

Co., Waterville, Me. In block system, presence of locomotive in one block changes resistance of circuits in adjacent blocks, thereby furnishing warning in those blocks of proximity of locomotive.

1,150,799. Method for Indicating a Ship's Approach and Means Therefor. E. C. Wood, assignor to Submarine Signal Co. Approaching body of magnetic metal disturbs magnetic field of submerged device, thereby producing an indication.

1,150,829. Signaling System. H. C. Wilson and C. R. B. Claflin, assignors to Atlantic National Bank, Providence, R. I. System having a transmitter and several receivers has "answer-back" to insure operation of all of the receivers.

1,150,835. Electric Trap. J. Satinover, Montreal, Quebec, Canada. Insects are electrocuted on oppositely charged alternate bars of cage. (See cut.)

Patents Expired.

The following United States electrical patents expired on August 23, 1915.

609,421. Device for Attaching or Detaching Electric-Lamp Bulbs. C. G. Edwards, Albert Lea, Minn.

609,466. Alloy of Iron and Titanium and Process of Producing It. A. J. Rossi, New York, N. Y.

609,639. Electromedical Apparatus. R. H. Wappler, New York, N. Y.

609,640. Burglar Alarm. D. L. Wartzenbuit, Kutztown, Pa.

609,702. Manufacture of Fluid for Impregnating Fibers for Incandescent Lighting. G. B. Puchmuller, Schoneberg, Germany.

609,732. Apparatus for Signaling on Locomotives. F. A. Chectham, Rastrick, and R. Bostock, Brighouse, England.

609,745. Diaphragm for Electrolytic Purposes. W. G. Luxton, Liverpool, England.